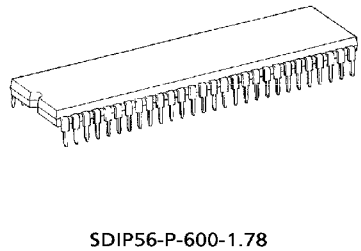
TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

TA8879N

1 CHIP NTSC COLOR TV

The TA8879N combines all the functions required for an NTSC color TV system in a 56-lead, dual-in-line shrink-type (1.78 mil) plastic package.
This device includes PIF / SIF circuits, video / chroma / deflection circuits, chroma band pass filters, red and green OSD interfaces, and 1ch Audio Video switches.



SDIP56-P-600-1.78

Weight : 5.55g (Typ.)

FEATURES

PIF Stage

- 3-stage variable-gain PIF amplification stage
- High-speed response AGC with dual time constants (peak AGC)
- Single end AFT output with defeat function
- RF delay AGC output (reverce AGC)
- Sync. negative detected video output polarity
- Internal black / white noise inverter
- Minimum externally mounted parts and adjusting spots

SIF Stage

- 3-stage limiter amplification stage
- Quadrature FM detector circuit with sound mute function
- 1ch external audio input
- High-performance electronic attenuater circuit
- Preamplifier circuit

Video Stage

- 2nd order-differential-type picture sharpness circuit (DC control)
- Contrast control with unicolor function
- Brightness control with pedestal clampling circuit (variable DC restoration ratio)
- External video input

Chroma Stage

- Internal 1/2 f_{SC} Trap
- Internal band pass filter
- ACC circuit
- Color control circuit
- Unicolor control circuit
- Color differential output
- Tint control circuit
- Adjustment-free APC Circuit

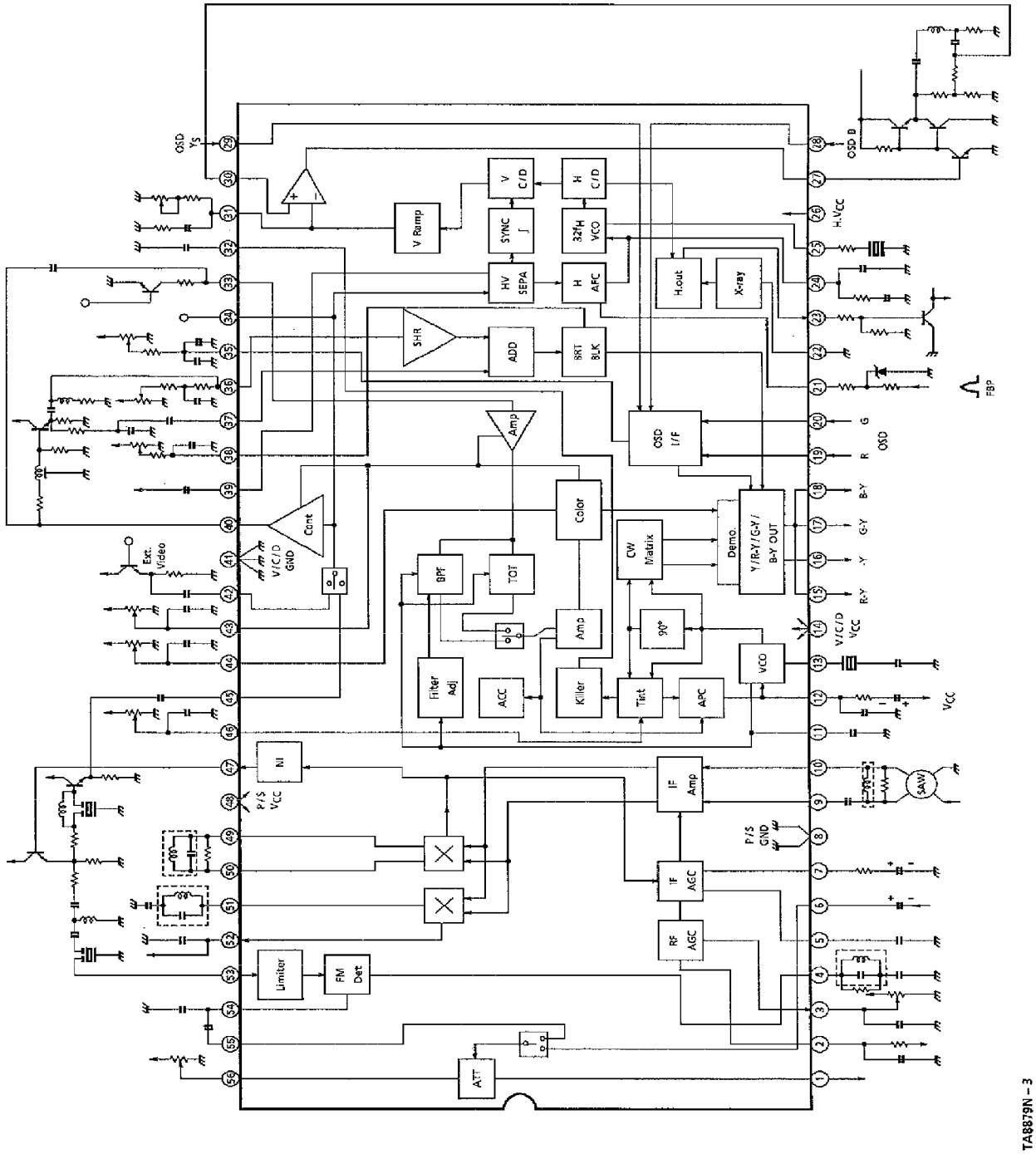
Defrection Stage

- High-performance sync separation circuit
- Adjustment free horizontal oscillation circuit
- Stable vertical synchronization
- Sawtooth-type AFC (internal sawtooth wave generator)
- Horizontal predrive output
- X-ray protection circuit
- Vertical NFB amplification circuit

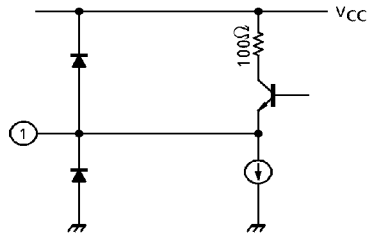
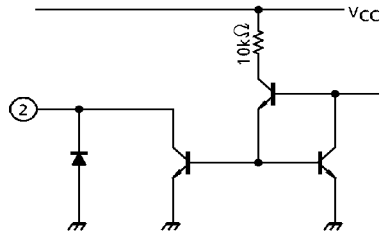
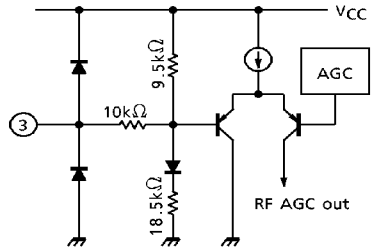
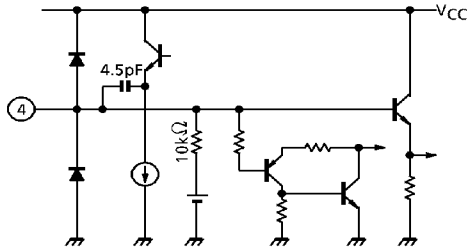
OSD interface Stage

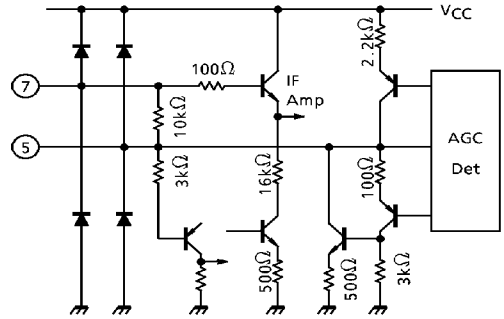
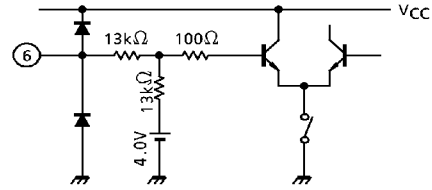
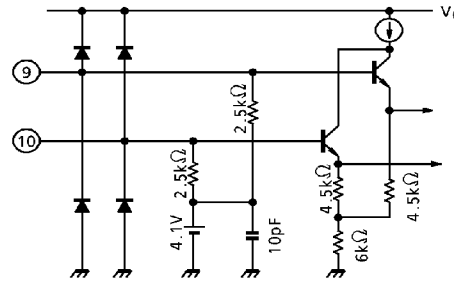
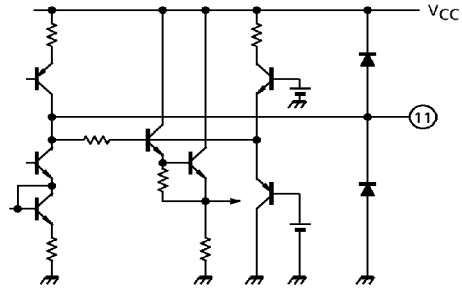
- Fast blanking SW

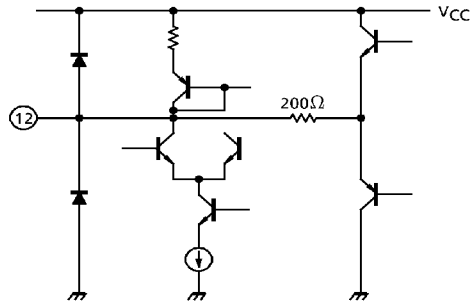
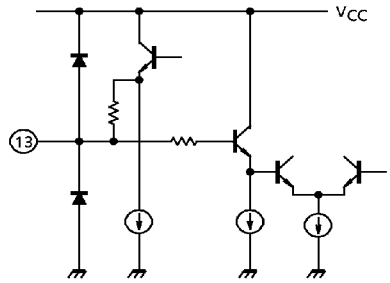
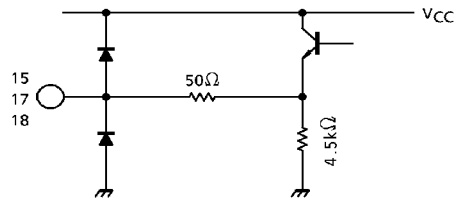
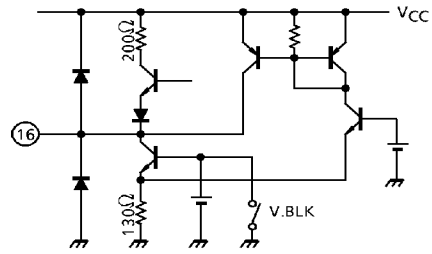
BLOCK DIAGRAM

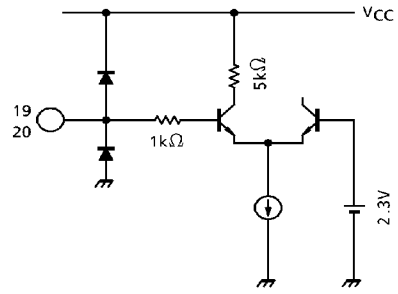
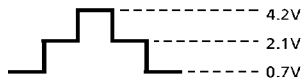
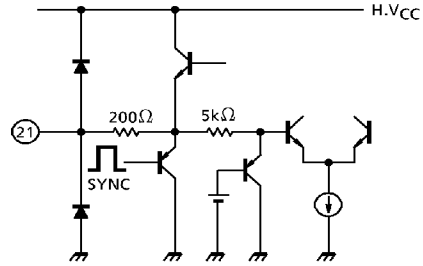
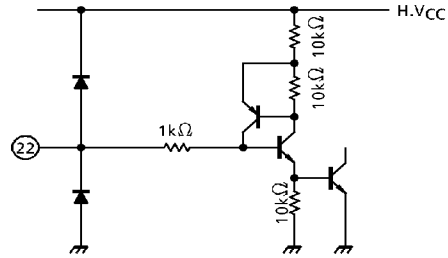
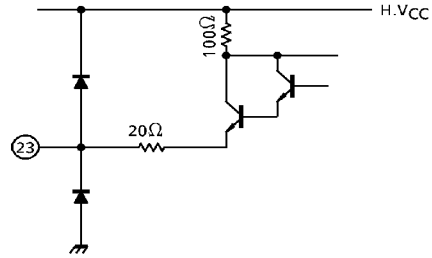


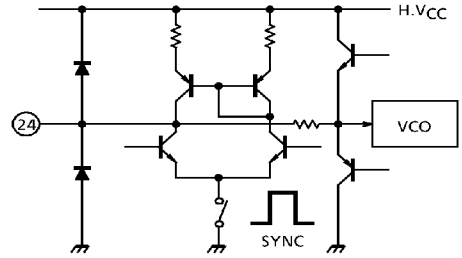
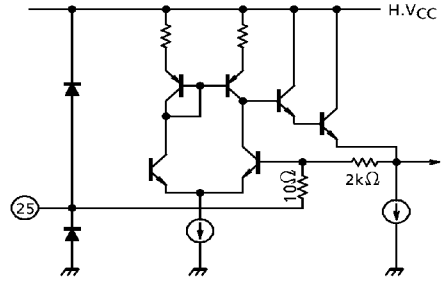
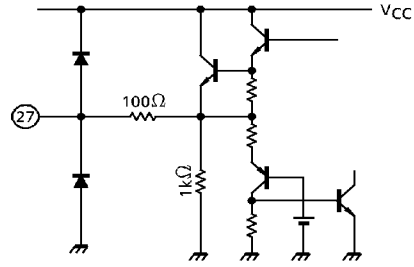
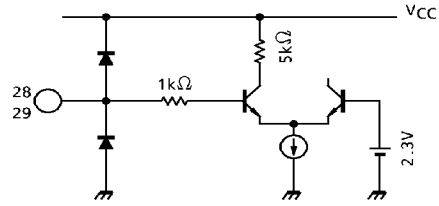
TERMINAL FUNCTION

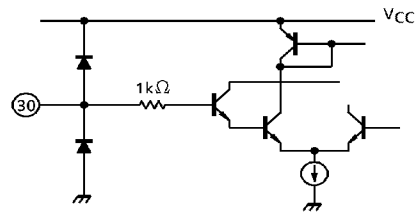
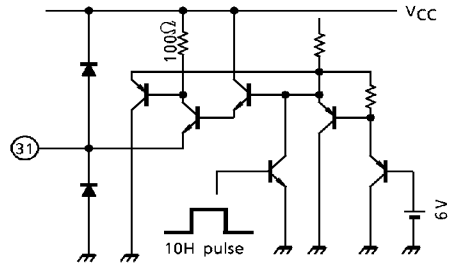
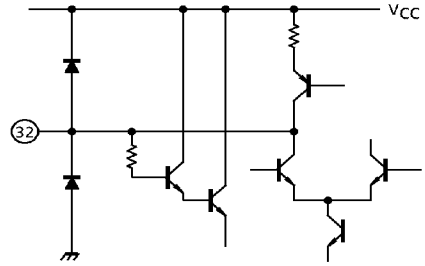
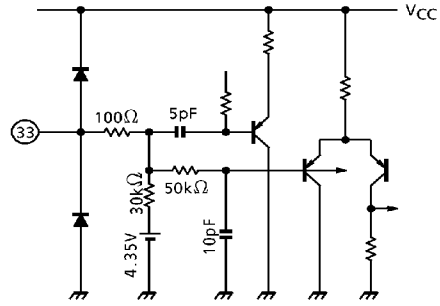
<table>
<tr><th>PIN No.</th><th>PIN NAME</th><th>FUNCTION</th><th>INTERFACE CIRCUIT</th></tr>
<tr><td>1</td><td>Audio Output</td><td>Emitter follower output for a volume controlled audio signal (TV / External) output stage
(Ref.)
<table>
<tr><th>MODE SELECT</th><th>MODE</th><th>INPUT</th><th>GAIN (ATT MAX)</th></tr>
<tr><td>Pin 33 open</td><td>TV</td><td>Pin 55</td><td>6dB</td></tr>
<tr><td>Pin 33 connected to GND through 47kΩ</td><td>EXT</td><td>Pin 6</td><td>0dB</td></tr>
</table></td><td> 
</td></tr>
<tr><td>2</td><td>RF AGC Output</td><td>An open collector output for RF AGC.
The gain is determined by an external load resistor.</td><td> 
</td></tr>
<tr><td>3</td><td>RF AGC Delay Adjust</td><td>The delay point of RF AGC is set by an applied external voltage.</td><td> 
</td></tr>
<tr><td>4</td><td>SIF Tank</td><td>A 4.5MHz tuned tank circuit is connected.
The detector muting function is on when this terminal is connected to GND.</td><td> 
</td></tr>
</table>

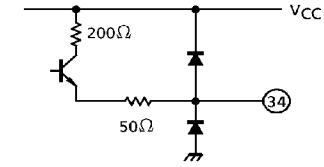
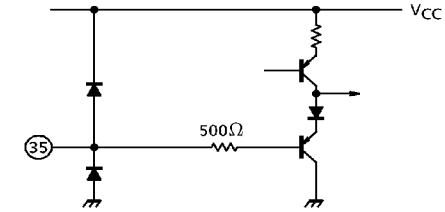
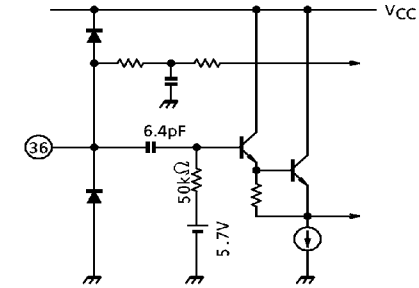
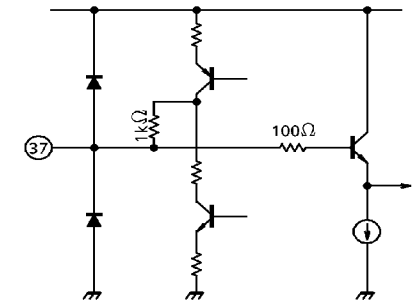
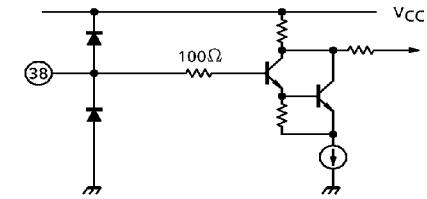
PIN No.	PIN NAME	FUNCTION	INTERFACE CIRCUIT
5 7	AGC Filter	Pin 5 and pin 7 are AGC time constant terminals A dual time constant system is adopted in order to achieve a high speed response.	
6	External Audio Input	External audio signal input terminal (Capacitor coupled input) (Ref.) External audio signal is selected when the terminal pin 33 is connected to GND through 47kΩ resistor.	
8	PIF / SIF GND	GND for PIF / SIF stage Decoupling capacitors should be connected between the terminal pin 48 and the terminal pin 8.	—
9 10	PIF Input	PIF signal input terminal Input impedance ; 2.5kΩ typ.	
11	Chroma filter and VCO Adjustment	The center frequency of the internal chroma filter and 3.58MHz VCO are adjusted simultaneously.	

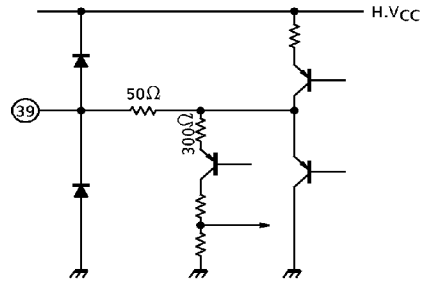
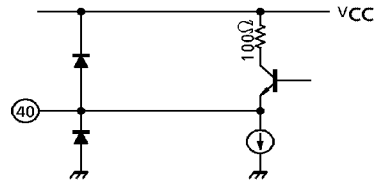
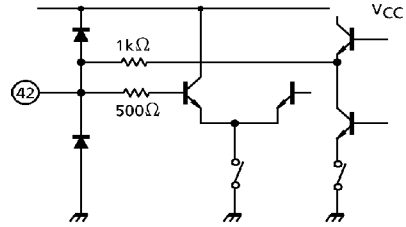
PIN No.	PIN NAME	FUNCTION	INTERFACE CIRCUIT
12	APC Filter	APC filter circuit is connected.	
13	3.58 X'tal	3.58MHz X'tal is connected.	
14	V / C / D V_{CC}	V_{CC} for video / chroma / deflection stage (V_{CC} = 9V typ., decoupling capacitors should be connected between the terminal pin 14 and pin 41)	—
15 17 18	R-Y Output G-Y Output B-Y Output	Color difference signal output terminal	
16	– Y Output	– Y signal output terminal Vertical blanking is generatecd internally, where as holizontal blanking should be added externally.	

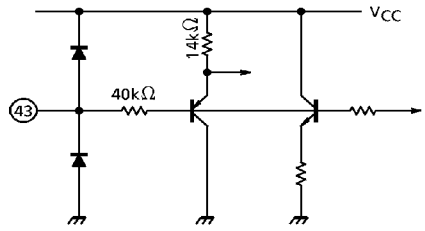
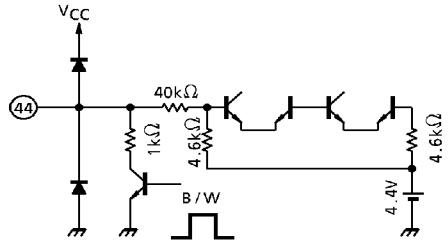
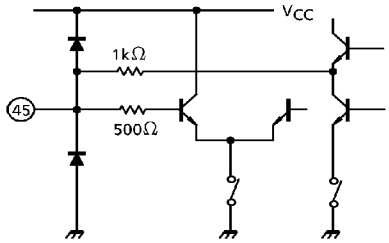
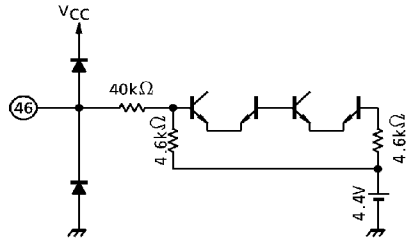
PIN No.	PIN NAME	FUNCTION	INTERFACE CIRCUIT
19 20	R OSD Input G OSD Input	OSD (On Screen Display) signal input terminal Threshold voltage : 2.3V (typ.) Max input level : 5.5V Min input level : −0.3V Max input Current in V_{CC} off : 7mA	
21	FBP Input	Input terminal for fly back pulse to horizontal AFC circuit (the integrator circuit for a sawtooth wave is provided internally.) Sync signal output terminal Pin 21 terminal voltage is clampled to 4.2V during sync pulse period. 	
22	X-ray Protector	The input terminal of the X-ray protector. Pin 23 horizontal drive terminal turns to "LOW" when the input voltage of this terminal exceeds the specified threshold voltage. (1.3V typ.)	
23	Horizontal Output	Horizontal drive output terminal (emitter follower) Amplitude : 5.0V_{p-p} (typ.) Duty : 43% (typ.)	

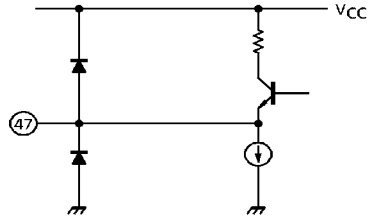
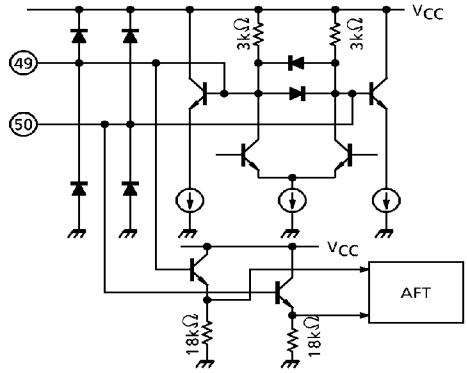
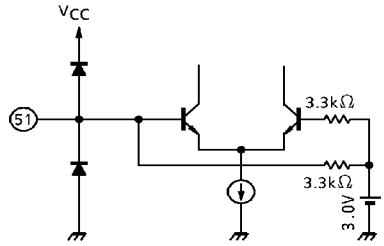
PIN No.	PIN NAME	FUNCTION	INTERFACE CIRCUIT
24	H.AFC	AFC filter is connected.	
25	32f_H VCO	32f_H oscillation circuit	
26	H.V_{CC}	V_{CC} for Horizontal Deflection H.V_{CC} = 9V typ. An external zener diode is required.	—
27	Vertical Output	Vertical output terminal (emitter follower) Test Mode The ramp wave at pin 31 is disappeared and the DC voltage of pin 31 becomes around 6V when 9V is applied to the terminal pin 27.	
28 29	B OSD Input Y_S Input	OSD (On Screen Display) signal input terminal Threshold voltage : 2.3V (typ.) Max input level : 5.5V Min input level : −0.3V Max input current in V_{CC} off : 7mA	

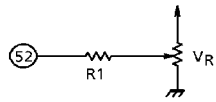
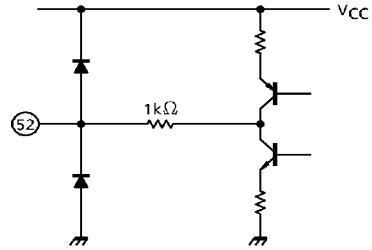
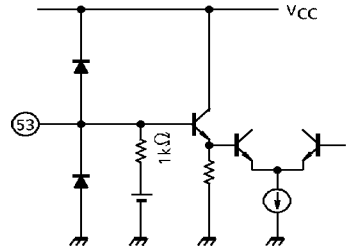
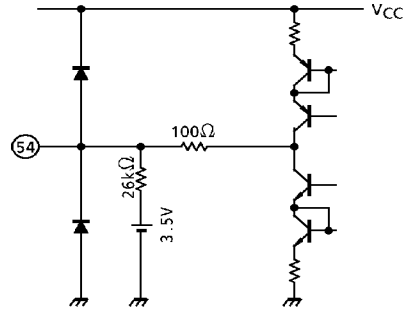
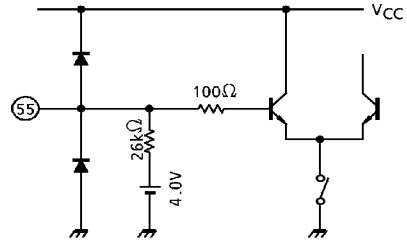
PIN No.	PIN NAME	FUNCTION	INTERFACE CIRCUIT
30	Vertical NFB	Input terminal for vertical NFB Amp. (AC, DC feedback)	
31	Vertical Ramp	The vertical ramp wave is generated at this terminal. During retrace period, external capacitor is charged by an internal current source, then, during trace period, an external capacitor is discharged by an external resistor. The vertical ramp voltage is subject to the horizontal V_{CC} (6V typ. when horizontal V_{CC} is 9V.)	
32	Killer Filter	Killer filter capacitor is connected.	
33	Chroma Input TV / EXT Switch S-VHS Switch	Chroma signal input terminal TV / External selection terminal Switching circuit for external Chroma signal input V33 [V] 3.25 TV MODE 2.15 EXT MODE S-VHS MODE S-VHS MODE : A compensation circuit for a unicolor control is disabled.	

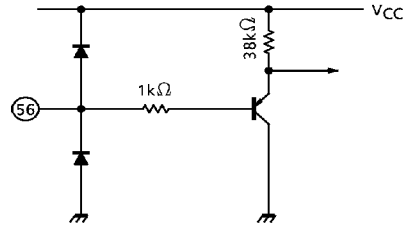
PIN No.	PIN NAME	FUNCTION	INTERFACE CIRCUIT
34	Video OUT (2)	Switching circuit for external chroma signal input Composite video signal with contrast amplitude is delivered from this terminal.	
35	OSD Bright	OSD signal brightness control terminal OSD brightness level is set by this terminal voltage.	
36	Picture Sharpness Control 2nd Order-differential Video Signal Input	2nd ordered-differential video signal input terminal Picture sharpness control terminal	
37	Video Input	Input terminal of delayed video signal	
38	Brightness Control	TV signal brightness control terminal DC restoration ratio is determined by the external resistors R_1 and R_2.	

<table>
<tr><th>PIN No.</th><th>PIN NAME</th><th>FUNCTION</th><th>INTERFACE CIRCUIT</th></tr>
<tr><td>39</td><td>Vertical Sepa. Filter</td><td>Vertical sync. separation filter is connected.</td><td> 
</td></tr>
<tr><td>40</td><td>Video Output (1)</td><td>Contrast controlled TV signal (from pin 45) and external video signal (from pin 42) are switched by terminal 33 voltage and delivered from this terminal.
<table>
<tr><th>MODE SELECT</th><th>MODE</th><th>INPUT</th><th>GAIN (CON-TRAST MAX)</th></tr>
<tr><td>Pin 33 open</td><td>TV</td><td>Pin 45</td><td>3.5dB</td></tr>
<tr><td>Pin 33 Connected to GND through 47kΩ</td><td>EXT</td><td>Pin 42</td><td>9.5dB</td></tr>
</table></td><td> 
</td></tr>
<tr><td>41</td><td>V / C / D GND</td><td>GND for Video / Chroma / Delection stage Decoupling capacitors should be connected between the terminal pin 14 and pin 41.</td><td>—</td></tr>
<tr><td>42</td><td>External Video Input</td><td>External video signal input terminal ($1V_{p-p}$ typ.)
(TV / External Selection : with pin 33 chroma signal input)</td><td> 
</td></tr>
</table>

PIN No.	PIN NAME	FUNCTION	INTERFACE CIRCUIT
43	Contrast Control	Uni-color control terminal (Gain control for video and color) Test Mode (1) Burst signal is appeared at the terminal pin 17 (G-Y output) when the terminal pin 43 voltage is set to 2.0V. Test Mode (2) Burst and chroma signal is appeared at the at the terminal pin 17 (G-Y output) when the terminal pin 43 voltage is set to 2.0V and pin 36 is set to 0.2V or connected GND thorough 3kΩ.	
44	Color Control	Color saturation control terminal This pin 44 is low at "killer" working.	
45	TV Input	TV video signal input terminal ($2V_{p-p}$ typ.) (TV / External Selection : with pin 33 chroma signal input)	
46	TINT Control	Hue control terminal Test Mode 3.58MHz X'tal drive wave form can be observed at the terminal pin 15, pin 17 and pin 18 when the terminal pin 46 voltage is set to lower than 1.3V.	

PIN No.	PIN NAME	FUNCTION	INTERFACE CIRCUIT
47	TV Video Output (VIF Output)	An output terminal for detected TV video signal. Video muting circuit operates when the terminal pin 5 is connected to GND.	
48	P/S V_{CC}	V_{CC} for PIF/SIF stage (V_{CC} = 9V typ.) Decoupling capacitors should be connected between the terminal pin 8 and pin 48.	—
49 50	PIF Tank	Terminals for a video DET tank circuit	
51	AFT Tank	A single ended tuned tank is connected. To defeat AFT, pin 45 is connected to GND through 10kΩ resistor.	

PIN No.	PIN NAME	FUNCTION	INTERFACE CIRCUIT
52	AFT Output	AFT output terminal AFT center voltage is determined by V_O, slope sensitivity is determined by $(R_1 + \frac{V_R}{2})$. 	
53	SIF Input	SIF signal input terminal	
54	De-Emphance	A SIF detection de-emphasis capacitor is connected. The output signal should be led to the terminal pin 55 through a coupling capacitor. In sound MPX Application, the signal from terminal pin 54 can be applied to the sound MPX decoder.	
55	Audio TV Input	TV audio signal input terminal (Audio signal from pin 54 is to be applied to pin 55 through a coupling capacitor.)	

PIN No.	PIN NAME	FUNCTION	INTERFACE CIRCUIT
56	Audio Volume Control	Volume control terminal Controlled by 0 to 5V DC, suitable to μ-computer control interface. A linear taper potentiometer can be used. The attenuation range is 70dB.	

OSD LOGIC TABLE

MODE	INPUT				OUTPUT		
	Y_S (PIN 29)	R (PIN 19)	G (PIN 20)	B (PIN 28)	R-Y (PIN 15)	B-Y (PIN 17)	G-Y (PIN 18)
TV	L	L	L	L	TV	TV	TV
Black	H	L	L	L	L	L	L
Red	(*)	H	L	L	H	L	L
Blue	(*)	L	L	H	L	H	L
Green	(*)	L	H	L	L	L	H
Yellow	(*)	H	H	L	H	L	H
Magenta	(*)	H	L	H	H	H	L
Cyan	(*)	L	H	H	L	H	H
White	(*)	H	H	H	H	H	H

(*) : Don't CARE

MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Power Supply Voltage	V_{CC}	13.0	V
Input Terminal Voltage	V_{in}	GND − 0.3V~V_{CC} + 0.3V	V
Input Signal Amplitude	e_{in}	4.0	V_{p-p}
Power Dissipation	P_D (Note)	1.92	W
Operating Temperature	T_{opr}	− 20~65	°C
Storage Temperature	T_{stg}	− 55~150	°C

(Note) When using the device at above Ta = 25°C, decrease the power dissipation by 15.3mW for each increase of 1°C.

RECOMMENDED POWER SUPPLY VOLTAGE

PIN No.	CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTE
14, 48	9V Power Supply Voltage	V_{CC}	8.5	9.0	9.5	V	—
26	9V Power Supply Voltage	H.V_{CC}					—

ELECTRICAL CHARACTERISTICS

DC CHARACTERISTICS (Unless otherwise specified, V_{CC} = 9V, H.V_{CC} = 9V, Ta = 25°C)

DC voltage characteristics

PIN No.	PIN NAME	SYM-BOL	MIN.	TYP.	MAX.	UNIT	NOTE
1	Audio Output	V1	4.0	4.7	5.2		SW4 : ON
2	RF AGC Output	V2	—	—	0.5		
3	RF AGC Delay	V3	5.8	6.2	6.7		
4	SIF Tank	V4	2.5	3.0	3.6		
5	1st AGC	V5	—	4	—		External Supply Voltage
6	External Audio Input	V6	3.3	4.0	5.1		
7	2nd AGC	V7	—	4	—		External Supply Voltage
8	PIF / SIF GND	V8	—	0	—		
9	PIF Input (1)	V9	3.5	3.9	4.5		
10	PIF Input (2)	V10	3.5	3.9	4.5		
11	f_C Adjustment	V11	3.5	4.5	5.5		
12	APC Filter	V12	5.9	6.4	6.9		
13	3.58 X'tal	V13	3.8	4.3	4.7		
14	V / C / D V_{CC}	V14	—	9.0	—		
15	R-Y output	V15	4.7	5.4	5.9		
16	– Y Output	V16	4.5	5.0	5.5		Bright Terminal 5.2V
17	G-Y Output	V17	4.7	5.4	5.9		
18	B-Y output	V18	4.7	5.4	5.9		
19	R OSD Input	V19	—	—	—	V	
20	G OSD Input	V20	—	—	—		
21	FBP Input	V21	0.5	0.9	1.2		
22	X-ray	V22	—	—	—		
23	Horizontal Output	V23	4.9	5.2	5.6		Ground via 10kΩ
24	Horizontal AFC	V24	6.7	7.2	7.8		
25	32f_H VCO	V25	4.80	5.2	5.75		
26	H.V_{CC}	V26	—	9.0	—		
27	Vertical Output	V27	2.9	3.5	4.1		
28	B OSD Input	V28	—	—	—		
29	Y_S OSD Input	V29	—	—	—		
30	Vertical NFB	V30	—	—	—		
31	Vertical Ramp	V31	5.9	6.1	6.3		
32	Killer Filter	V32	5.3	5.7	6.2		
33	Chroma Input	V33	3.8	4.35	4.8		
34	Video Out (2)	V34	1.7	2.0	2.3		Ground via 6.8kΩ
35	OSD Bright Control	V35	—	—	—		
36	Sharpness Control	V36	5.2	5.7	6.2		
37	Video IN	V37	4.6	5.1	5.6		Bright Terminal 5.2V

PIN No.	PIN NAME	SYM-BOL	MIN.	TYP.	MAX.	UNIT	NOTE
38	Brightness Control	V38	—	—	—	V	
39	Vertical Sync Sepa. Filter	V39	—	—	—		
40	Video OUT (1)	V40	1.6	2.4	3.2		
41	V/C/D GND	V41	—	0	—		
42	External Video Input	V42	2.0	2.5	3.0		External Input Mode
43	Contrast Control	V43	4.9	5.5	6.0		
44	Color Control	V44	3.9	4.4	4.8		
45	TV Input	V45	2.3	2.8	3.3		TV Mode
46	Tint Control	V46	3.9	4.4	4.8		
47	TV Detection Output	V47	4.2	4.6	4.9		
48	PIF/SIF V_{CC}	V48	—	9.0	—		
49	PIF Tank (1)	V49	6.2	6.8	7.1		
50	PIF Tank (2)	V50	6.2	6.8	7.1		
51	AFT Tank	V51	2.6	3.0	3.4		
52	AFT Output	V52	2.3	3.8	5.3		
53	SIF Input	V53	2.6	3.0	3.4		
54	De-emphasis	V54	2.7	3.5	4.2		SW4 : ON
55	Audio TV Input	V55	3.3	4.0	5.1		
56	Audio Control	V56	—	—	5		

Power consumption, power dissipation

CHARACTERISTIC			SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTE
Power Supply Current	PIF		I1	18	26	34	mA	"Video" includes OSD part.
	SIF		I2	7	11	15		
	Video		I3	15	22	29		
	Chroma		I4	14	22	29		
	Deflection	V_{CC}	I5	1	2	3		
		$H.V_{CC}$	I6	7	10	13		
Total Current		V_{CC}	I_{CC}	55	83	110	mA	
		$H.V_{CC}$	I_{CCH}	7	10	13		
Total Power Dissipation			P_D	558	837	1107	mW	

AC CHARACTERISTICS (Unless otherwise specified, V_{CC}, $H.V_{CC}$ = 9V, Ta = 25°C)
PIF stage

CHARACTERISTIC		SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Input Sensitivity		V_{IN}	2	(Note 1)	—	38	46	dBμV
IF AGC Range		GR	2	(Note 2)	60	67	—	dB
Video Band Width		f_{VBW}	2	(Note 3)	4.5	—	—	MHz
Differential Gain		DG	2	(Note 4)	—	—	5	%
Differential Phase		DP			—	—	10	°
Video Output Amplitude		V_{p-p}	2	(Note 5)	1.7	1.9	2.3	V_{p-p}
No-signal Level		$V_{47\,(o)}$	2	(Note 6)	4.3	4.6	4.9	V
Sync Tip Level		V_{SYNC}	2	(Note 7)	2.1	2.3	2.5	V
Black Noise Inverter Level		V_{BTH}	2	(Note 8)	1.3	1.7	2.1	V
Black Noise Clamp Level		V_{BCL}			3.2	3.6	4.0	
Carrier Suppression Ratio		I_O	2	(Note 9)	40	—	—	dB
Harmonic Suppression Ratio		I_H			40	—	—	
Input Impedance		R_{IN}	2	(Note 10)	1.75	2.5	3.25	kΩ
		C_{IN}			2	4	8	pF
AFT Center Voltage	No Signal	ΔV_{52}	2	(Note 11)	2.3	3.8	5.3	V
	Offset	ΔV52			− 1.5	0	1.5	
AFT Sensitivity		f / V	2	(Note 12)	—	—	27	kHz / V
AFT Voltage Swing		A	2	(Note 13)	6	8.7	—	V
920kHz Beat		I_{920}	2	(Note 14)	32	—	—	dB

SIF stage

CHARACTERISTIC		SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
FM Detection Output		V_{OD}	2	(Note 15)	110	150	—	mV_{rms}
Limiting Sensitivity		V_{IN}	2	(Note 16)	—	51	58	dBμV
AM Rejection Ratio		AMR	2	(Note 17)	30	—	—	dB
Band Width (− 3dB)		f_1-f_2	2	(Note 18)	150	210	—	kHz
Preamp Gain (ATT Max.)	TV	G_{VATT}^{TV}	2	(Note 19)	—	6.0	—	dB
	EXT	G_{VATT}^{EXT}			—	0	—	
ATT Max. Attenuation		X_{MAX}	2	(Note 20)	70	—	—	dB
ATT Max. Input Voltage	TV	V_{INMX}^{TV}	2	(Note 21)	1.5	2.5	—	V
	EXT	V_{INMX}^{EXT}			3.1	5.0	—	

Video stage (Video amp)

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Video Output Drive Current	I#40	3	(Note 22)	2.0	3.2	4.7	mA
Min. Linear Video Input (Pin 42, 45)	V_{di1}^{TV}	3	(Note 23)	—	1.7	2.4	V
	V_{di1}^{EXT}			—	2.0	2.3	
Max. Linear Video Input (Pin 42, 45)	V_{di2}^{TV}			5.1	5.4	—	
	V_{di2}^{EXT}			3.7	3.9	—	
Video Input Dynamic Range (Pin 42, 45)	V_{diA}^{TV}	3	(Note 24)	3.0	3.7	—	V
	V_{diA}^{EXT}			1.5	1.9	—	
Min. Output (Pin 42, 45)	V_{do1}	3	(Note 25)	—	0.8	1.0	V
Max. Output (Pin 42, 45)	V_{do2}			7.3	7.7	—	
AC Gain (Pin 42, 45→Pin 40)	G_{V1}^{TV}	3	(Note 26)	1.35	1.5	1.65	Times
	G_{V1}^{EXT}			2.55	3.0	3.45	
Frequency Response (Pin 42, 45→Pin 40)	ΔG_{f1}	3	(Note 27)	− 1	− 0.25	0	dB
Contrast Control Gain Variable Range	ΔG_{ct}	3	(Note 28)	11	12	13	dB
Contrast Control Voltage Range	V_{ct}	3	(Note 29)	0.5	1.2	1.9	V_{p-p}
Contrast Control Center Voltage	V_{cto}	3	(Note 30)	5.2	5.5	5.8	V
TV→EXT Crosstalk	$V_{T\rightarrow E}$	3	(Note 31)	− 49	− 60	—	dB
	$V_{E\rightarrow T}$						
TV→EXT Mode Switching Level	$V_{T\rightarrow E}$	3	(Note 32)	2.95	3.25	3.55	V
EXT→TV Mode Switching Level	$V_{E\rightarrow T}$	3	(Note 33)	2.95	3.25	3.55	V
AC Gain (Pin 42, 45→Pin 34)	G_{V2}^{TV}	3	(Note 34)	0.89	1.00	1.12	Times
	G_{V2}^{EXT}			1.78	2.00	2.24	

(Y signal process)

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Brightness Control Adjust Voltage	V_{BR}	3	(Note 35)	4.8	5.2	5.6	V
Brightness Control Sensitivity	G_{BR}	3	(Note 36)	– 2.4	– 2.85	– 3.6	Times
Min. Linear Video Input (Pin 37)	V_{di4}	3	(Note 37)	6.2	6.5	—	V
Max. Linear Video Input (Pin 37)	V_{di3}			—	4.6	4.8	
Video Input Dynamic Range (Pin 37)	V_{diB}	3	(Note 38)	1.5	1.8	—	V
Min. Output (Pin 37)	V_{do3}	3	(Note 39)	—	0.8	1.1	V
Max. Output (Pin 37)	V_{do4}			6.7	7.0	9.0	
Dynamic Range of 2nd-order Differential Video Input	V_{dip}	3	(Note 40)	0.4	0.5	0.65	V
AC Gain (Pin 37→Pin 16)	G_{v2}	3	(Note 41)	2.4	2.8	3.1	Times
Frequency Characteristics (Pin 37→Pin 16)	G_{f2}	3	(Note 42)	– 3	– 1	– 0.4	dB
Gain Variation (Min. Sharpness)	ΔG_{ps}^{MIN}	3	(Note 43)	– 2.2	– 4.5	– 6.3	dB
Gain of Picture Sharpness Control	G_{ps}	3	(Note 44)	17.5	20	24	dB
Picture Sharpness Control Characteristics	ΔG_{ps}	3	(Note 45)	– 3.0	– 0.7	0	dB
Picture Sharpness Control Range	ΔV_{ps}	3	(Note 46)	1.53	2.7	3.24	V_{p-p}
V-BLK Pulse Output Level	V_V	3	(Note 47)	8.0	8.9	9.0	V
Y Output Drive Current	I#16	3	(Note 48)	1.0	2.0	3.0	mA

OSD interface stage

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
OSD Output DC Voltage	V_{OUTR}^{L} V_{OUTG}^{L} V_{OUTB}^{L}	3	(Note 49)	4.4	4.7	5.0	V
	V_{OUTY}^{L}			4.1	4.3	4.5	
OSD Output Hi Voltage	V_{OUTR}^{H} V_{OUTG}^{H} V_{OUTB}^{H}	3	(Note 50)	6.5	6.7	6.9	V
R OSD Threshold Voltage	V_{SWR}^{OSD}	3	(Note 51)	2.10	2.30	2.50	V
G OSD Threshold Voltage	V_{SWG}^{OSD}	3	(Note 52)	2.10	2.30	2.50	V
B OSD Threshold Voltage	V_{SWB}^{OSD}	3	(Note 53)	2.10	2.30	2.50	V
YS Threshold Voltage	V_{SWY}^{OSD}	3	(Note 54)	2.10	2.30	2.50	V
Output High Level Rise Time	τ_{R}^{H}	3	(Note 55)	—	25	100	ns
Output High Level Propagation Delay Time (Rising Edge)	t_{PR}^{H}			—	15	100	
Output High Level Fall Time	τ_{F}^{H}			—	30	100	
Output High Level Propagation Delay Time (Falling Edge)	t_{PF}^{H}			—	20	100	
Output Low Level Rise Time	τ_{R}^{L}	3	(Note 56)	—	25	100	ns
Output Low Level Propagation Delay Time (Rising Edge)	t_{PR}^{L}			—	10	100	
Output Low Level Fall Time	τ_{F}^{L}			—	20	100	
Output Low Level Propagation Delay Time (Falling Edge)	t_{PF}^{L}			—	10	100	

Chroma stage

CHARACTERISTIC		SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
ACC Characteristics	TV	a	4	(Note 57)	0.04	0.09	—	V_{p-p}
		A			—	1.0	1.30	Times
		F1			0.13	0.16	0.20	V_{p-p}
	EXT	a			0.03	0.08	—	V_{p-p}
		A			—	1.0	1.30	Times
		F1			0.13	0.16	0.20	V_{p-p}
Color Control Voltage		V44	4	(Note 58)	3.93	4.37	4.75	V
Color Control Range		ΔV44			0.64	1.26	1.88	
Uni-color Control Gain Variation Range		e_U	4	(Note 59)	10.4	11.4	13.6	dB
Uni-color Control Adjust. Voltage		V43			4.94	5.49	5.97	V
Uni-color Control Adjust. Voltage Range		ΔV43			0.64	1.26	1.88	
Chroma Input Terminal Voltage	TV	V_{33}^{TV}	4	(Note 60)	3.8	4.35	4.8	V
	EXT	V_{33}^{EXT}			1.90	2.20	2.50	
Tint Control Range (part)		$\Delta\theta_1$	4	(Note 61)	45	55	65	°
		$\Delta\theta_2$			45	35	25	
Tint Control Voltage		V46	4	(Note 62)	3.93	4.37	4.75	V
Tint Control Voltage Range		ΔV46			0.64	1.26	1.88	
Frequency Control Sensitivity		β	4	(Note 63)	0.9	1.5	2.1	Hz / mV
APC Pull-in, Hold Range		f_{ph}	4	(Note 64)	+ 250	+ 500	—	Hz
		f_{pl}			− 250	− 500	− 3000	
		f_{Hh}			+ 300	+ 500	—	
		f_{Hl}			− 300	− 500	− 3000	
Killer Operation Input Level	TV	e_k^{TV}	4	(Note 65)	1.4	2.8	4.5	mV_{p-p}
	EXT	e_k^{EXT}			1.0	2.0	3.2	
Demodulator Output DC Voltage		V15, V16, V17	4	(Note 66)	4.7	5.4	5.9	V
Color Difference Output		e_R	4	(Note 67)	0.31	0.46	0.63	V_{0-p}
		e_G			0.11	0.16	0.22	
		e_B			0.37	0.54	0.73	
Max. Color Difference Output		E_R	4	(Note 68)	3.73	4.40	5.60	V_{p-p}
		E_G			1.20	1.40	1.80	
		E_B			3.73	4.40	5.60	

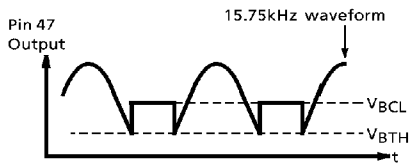
CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Relative Amplitude	R / B	4	(Note 69)	0.71	0.84	0.97	—
	G / B			0.21	0.34	0.47	
Relative Phase	R-B	4	(Note 70)	97	104	113	°
	G-B			225	240	250	
Demodulator Output Residual Carrier	E_{CR}	4	(Note 71)	—	—	10	mV_{p-p}
	E_{CG}			—	—	4	
	E_{CB}			—	—	10	
Demodulator Output Residual Harmonics	E_{HR}	4	(Note 72)	—	—	100	mV_{p-p}
	E_{HG}			—	—	40	
	E_{HB}			—	—	120	
S VHS SW Threshold Voltage	VS_{SW}	4	(Note 73)	1.85	2.15	2.45	V

Deflection circuit

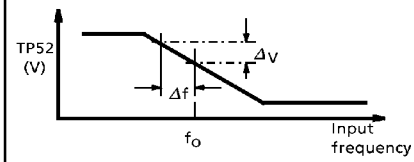
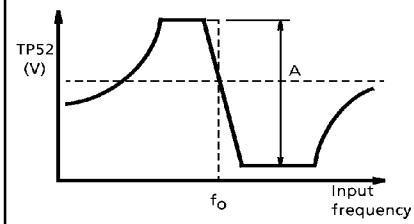
CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Sync. Separation Input Current Sensitivity	I_{IN45}	5	(Note 74)	15	25	40	μA
H.AFC Phase Detection Current	I_{DET}	5	(Note 75)	230	330	460	
Phase Detection Masking Period	T_{CO24}	5	(Note 76)	—	258 ~6H	—	—
$32f_H$ VCO Oscillation Start Voltage	V_{ON}	5	(Note 77)	—	—	4.0	V
Horizontal Output Start Voltage	V_{ON23}	5	(Note 78)	4.0	4.5	5.0	V
Horizontal Free-running Frequency	f_o	5	(Note 79)	15.584	15.734	15.884	kHz
Horizontal Frequency Control Ranage	f_{max}	5	(Note 80)	16.400	16.600	16.800	kHz
	f_{min}			14.600	15.000	15.300	
Horizontal Frequency Control Sensitivity	β_H	5	(Note 81)	2.0	2.3	2.6	kHz / V
Horizontal Output Duty Ratio	T_{O23}	5	(Note 82)	41	43	45	%
Horizontal Output Voltage	V_{H23}	5	(Note 83)	4.7	5.0	5.5	V
	V_{L23}			—	0	0.1	
X-ray Protection Threshold Voltage	V_{I22}	5	(Note 84)	1.1	1.3	1.5	V
X-ray Protection Hold Voltage	V_{H26}	5	(Note 85)	—	—	2.5	V
Vertical Output Pulse Width	T_{r1}	5	(Note 86)	—	10H	—	—
	T_{r2}			—	10H	—	
V-Ramp Max. Output Voltage	V_{H31}	5	(Note 87)	5.7	6.1	6.3	V
V-Ramp Max. Output Current	I_{O31}	5	(Note 88)	—	23	—	mA
Vertical Amplifier Gain	G_V	5	(Note 89)	18	20	22	dB
Vertical Output Max. Voltage	V_{H27}	5	(Note 90)	2.9	3.5	4.1	V
Vertical Output Min. Voltage	V_{L27}	5	(Note 91)	—	—	0.3	V
Vertical Output Max. Current	I_{O27}	5	(Note 92)	20	35	—	mA
Pull-in Range Of Vertical Oscillator	f_{pv1}	5	(Note 93)	—	224.5H	—	—
	f_{pv2}			—	296.5H	—	

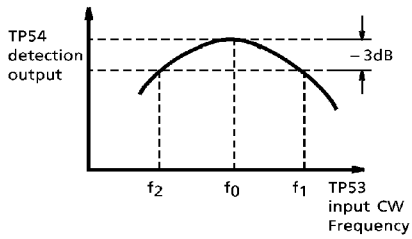
TEST CONDITION
PIF stage

NOTE No.	ITEM	MEASUREMENT CONDITION (V_{CC} = 9.0V, Ta = 25°C)						MEASUREMENT METHOD
		SW & VR MODE						
		SW7	SW51	SW53	VR3	SW33B	—	
1	Input Sensitivity	OFF	OFF	B	Max.	A	—	(1) TP9A : Input f_O = 58.75MHz, 84dBμV, 15.75kHz sine wave, 30% AM (2) TP7 : Open (3) Measure the input signal level to make the detection output signal (TV detection signal : TP47B) level = 0.6V_{p-p}.
2	IF AGC Range							(1) TP9A : Input f_O = 58.75MHz, 84dBμV, 15.75kHz sine wave, 30% AM (2) Measure the input level v_1 to make the detection output signal (TV detection signal : TP47B) = 0.6V_{p-p} constantly in case of TP7 voltage = 9V. Measure the input level v_2 by the same way above in case of TP7 voltage = 3V. (3) Calculate the GR = 20ℓog (v_1 / v_2)
3	Video Band Width							(1) Set SG1 : f_O = 58.75MHz, 84dBμV, SG2 : f_m = variable (2) TP9A : Input SG1 + SG2 through the 2 signal mixer pad. (3) Adjust the TP7 external AGC voltage and SG2 output level to make the AC amplitude = 0.6V_{p-p} and DC level = 5V. (4) Sweep f_m, measure the TV detection signal (TP47A).

NOTE No.	ITEM	MEASUREMENT CONDITION (V_{CC} = 9.0V, Ta = 25°C)						MEASUREMENT METHOD
		SW & VR MODE						
		SW7	SW51	SW53	VR3	SW33B	—	
4	Differential Gain Differential Phase	OFF	OFF	B	Max.	A	—	(1) TP9A : Input the DG / DP Meter signal of 87.5% modulated with IF 2 signal SG (2) Measure the TV detection signal (TP47A) with synchronous scope through DG / DP Meter.
5	Video Output Amplitude							(1) TP9A : Input f_O = 58.75MHz, 84dBμV, 15.75kHz sine wave, 78% AM (2) Measure the TV detection output amplitude (TP47A).
6	No-signal Level							(1) TP7 : 4V (external AGC voltage) (2) Measure the TV detection output DC level (TP47A) with digital voltmeter.
7	Sync Tip Level							(1) TP9A : Input f_O = 58.75MHz, 84dBμV, CW (2) Measure the TV detection output DC level (TP47A) with digital voltmeter.
8	Black Noise Inverter Level Black Noise Clamp Level							(1) TP9A : Input f_O = 58.75MHz, 84dBμV, 15.75kHz sine wave, 78% AM (2) Monitor the TV detection signal (TP47A). Adjust the TP7 voltage to make the waveform as the fig. below. (3) Measure the V_{BTH}, V_{BCL} 

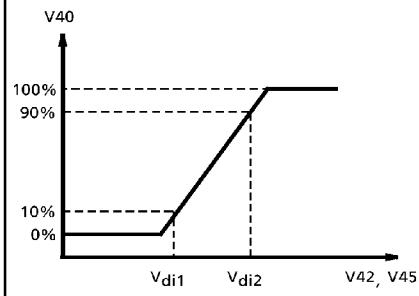
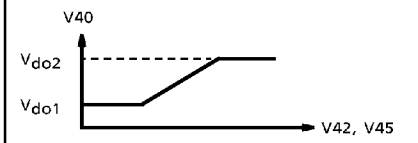
NOTE No.	ITEM	MEASUREMENT CONDITION (V_{CC} = 9.0V, Ta = 25°C)						MEASUREMENT METHOD
		SW & VR MODE						
		SW7	SW51	SW53	VR3	SW33B	—	
9	Carrier Suppression Ratio Harmonic Suppression Ratio	OFF	OFF	B	Max.	A	—	(1) TP9A : Input f_O = 58.75MHz, 84dBμV, 15.75kHz sine wave, 78% AM (2) Adjust the TP7 voltage (external AGC) to make the TV detection signal (TP47A) Level = $2V_{p\text{-}p}$. (3) Change TP9A to CW. Measure the leakage voltage at TP47A. Calculate the ratio Io = leakage / $2V_{p\text{-}p}$. (4) Measure the 117.5MHz leakage voltage at TP47A. Calculate the ratio I_H = 117.5MHz leakage / $2V_{p\text{-}p}$.
10	Input Impedance (1) Single Input Resistance (2) Single Input Capacitance							(1) TP7 : 4V (external AGC) (2) Measure the impedance between pin 9, 10 and GND.
11	AFT Center Voltage (1) No signal (2) AFT Mute Offset Voltage		(1) OFF					(1) TP9A : No signal input (AC GND) (2) TP7 : 4V (external AGC) (3) Measure the V_{52} = TP52 voltage with digital voltmeter at AFT mute off. (SW51 : OFF). (4) Measure the TP52 voltage at AFT mute ON (SW51 : ON). Calculate ΔV52 = difference from V52
			(2) ON					

NOTE No.	ITEM	MEASUREMENT CONDITION (V_{CC} = 9.0V, Ta = 25°C) SW & VR MODE						MEASUREMENT METHOD
		SW7	SW51	SW53	VR3	SW33B	—	
12	AFT Sensitivity	OFF	OFF	B	Max.	A		(1) TP9A : Input f_O = 58.75MHz, 84dBμV, CW (2) Sweep the input signal frequency. Measure the ΔV = Voltage changing of TP52. (3) Calculate $\Delta f / \Delta V$. 
13	AFT Voltage Swing						—	(1) Same as (1) for note 12. (2) Same as (2) for note 12. (3) Measure the "A" in the fig. below. 
14	920kHz Beat							(1) Set SG1 : IF 2 signal P = 58.75MHz, 84dBμV S = 54.25MHz, 74dBμV Set SG2 : C = 55.17MHz, 74dBμV (2) TP9A : Input SG1 + SG2 through 2-signal mixer pad (3) Adjust the external AGC voltage to make the TV detection signal (TP47A) sync tip level = 2.4V. Measure the level difference between 3.58MHz and 920kHz.

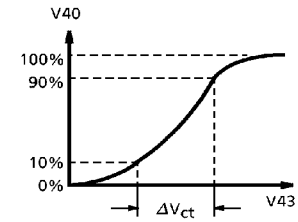
NOTE No.	ITEM	MEASUREMENT CONDITION (V_{CC} = 9.0V, Ta = 25°C)						MEASUREMENT METHOD
		SW & VR MODE						
		SW4	SW33B	SW53	SW54	VR56	—	
15	FM Detection Output	OFF	—	B	OFF	Max.		(1) TP53 : Input f_O = 4.5MHz, 100dBμV, 400Hz, 7.5kHz / DEV.FM (2) Measure the amplitude of TP54 output.
16	Limiting Sensitivity							(1) Same as (1) for note 15. (2) Decrease the input level and measure the −3dB limiting point.
17	AM Rejection Ratio						—	(1) TP53 : Input f_O = 4.5MHz FM : 400Hz, 7.5kHz / DEV., 100dBμV Measure the output level (TP54) = V_{FM} (2) TP53 input f_O = 4.5MHz, AM : 400Hz, 30%, 100dBμV Measure the output level (TP54) = V_{AM} (3) Calculate the AMR = 20ℓog (V_{FM} / V_{AM})
18	Band Width (−3dB)							(1) Same as (1) for note 15. (2) Measure the −3dB Band Width (f_2-f_1) 

NOTE No.	ITEM	MEASUREMENT CONDITION (V_{CC} = 9.0V, Ta = 25°C)						MEASUREMENT METHOD
		SW & VR MODE						
		SW4	SW33B	SW53	SW55	VR56	—	
19	Pre amp Gain (ATT max.)	OFF	A (TV) B (Ext)	B	OFF	Max.	—	(1) TV mode : Pin 55 : Input 1kHz, 250mV$_{rms}$, through 4.7μF Ext mode : TP6 : Input 1kHz, 500mV$_{rms}$ (2) Measure the output level for each mode (3) Calculate the $G_{V\ ATT}$ = 20ℓog (v_{out} / v_{in}) for each mode.
20	ATT Max. Attenuation		B			Adj.		(1) TP6 : Input 1kHz, 500mV$_{rms}$ (2) Measure the VR_{max} output amplitude (v_{MAX}) and VR_{min} output amplitude (v_{MIN}) at TP1. (3) Calculate the X_{MAX} = 20ℓog (v_{MAX} / v_{MIN}). (Use 1kHz BPF.)
21	ATT Max. Input Voltage		A (TV) B (Ext)					(1) TV mode : Pin 55 : Input 1kHz Ext mode : TP6 : Input 1kHz (2) Adjust the VR56 to make the TP56 DC voltage = 2.5V. (3) Sweep : Input amplitude Monitor : TP1 output Measure : The input amplitude just before making the TP1 output be distorted.

Video stage (Video amp)

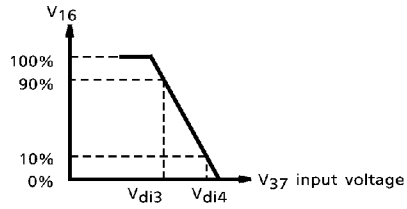
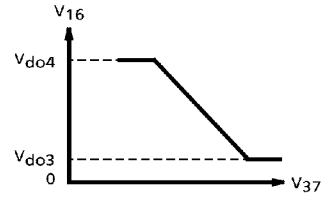
NOTE No.	ITEM	MEASUREMENT CONDITION (V_{CC} = 9.0V, Ta = 25°C) SW & VR MODE						MEASUREMENT METHOD
		SW 19, 20	SW33B	SW42	SW43	SW45	—	
22	Video Output Drive Current	C	A	B	A (Max.)	B	—	(1) Pin 40 (Video output) : Impress 6V externally (2) Measure the flow into current to pin 40.
23	Min. Linear Video Input (Pin 42, 45)		A (TV)					(1) TV mode : Vary the TV input (pin 45) DC voltage Ext mode : Vary the external input (pin 42) DC voltage (2) Monitor : Pin 40 DC voltage (3) Measure the V_{di1}, V_{di2} in the fig. below. 
	Max. Linear Video Input (Pin 42, 45)		B (Ext)					
24	Video Input Dynamic Range (Pin 42, 45)							(1) Same as (1) for note 23. (2) Same as (2) for note 23. (3) Same as (3) for note 23. (4) Calculate $V_{diA} = V_{di2} - V_{di1}$
25	Min. Output (Pin 42, 45)							(1) Same as (1) for note 23. (2) Measure the pin 40 maximum output and minimum output. 
	Max. Output (Pin 42, 45)							

NOTE No.	ITEM	MEASUREMENT CONDITION (V_{CC} = 9.0V, Ta = 25°C) SW & VR MODE						MEASUREMENT METHOD
		SW 19, 20	SW33B	SW42	SW43	SW45	—	
26	AC Gain (Pin 42, 45→ Pin 40)	C	A (TV) B (Ext)	B (TV) A (Ext)	A (Max.)	A (TV) B (Ext)	—	(1) TV mode : Pin 45 (TV input) : Input 0.4V_{p-p}, 10kHz sine wave Ext mode : Pin 42 (Ext input) : Input 0.2V_{p-p}, 10kHz sine wave (2) Measure : Pin 40 (Video out) output amplitude v_{40}.
27	Frequency Response (Pin 42, 45→ Pin 40)							(1) TV mode : Pin 45 (TV input) : Input 0.4V_{p-p}, 100kHz and 6MHz Ext mode : Pin 42 (Ext input) : Input 0.2V_{p-p}, 100kHz and 6MHz (2) Same as (2) for note 26. (3) Calculate $G_{f1} = 20\ell og \left(v_{40}^{6MHz} / v_{40}^{100kHz} \right)$ for each mode.
28	Contrast Control Gain Variable Range			A (Ext) B (TV)	A (Adj)			(1) Same as (1) for note 26. (2) Measure the video output (pin 40) amplitude v_{40}. v_{40max} : In case of max. contrast v_{40min} : In case of min. contrast (3) Calculate $\Delta G_{ct} = 20\ell og\ (v_{40max} / v_{40min})$

NOTE No.	ITEM	MEASUREMENT CONDITION (V_{CC} = 9.0V, Ta = 25°C)						MEASUREMENT METHOD
		SW & VR MODE						
		SW 19, 20	SW33B	SW42	SW43	SW45	—	
29	Contrast Control Voltage Range	C	A (TV) B (Ext)	A (Ext) B (TV)	A (Adj)	A (TV) B (Ext)	—	(1) Same as (1) for note 26. (2) Monitor the video output (pin 40). Vary the contrast from min to max. Measure the contrast adjusting terminal (pin 43) DC voltage. (3) Calculate the ΔV_{ct} in the fig. below. 
30	Contrast Control Center Voltage							(1) Same as (1) for note 26. (2) Same as (2) for note 28. (3) Measure the contrast adjusting terminal (pin 43) DC voltage to make the pin 40 output amplitude = $(v_{40max} + v_{40min}) / 2$

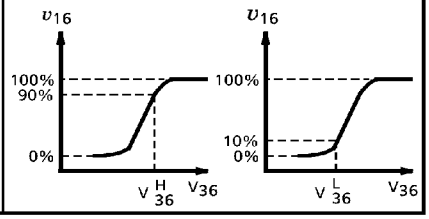
NOTE No.	ITEM	MEASUREMENT CONDITION (V_{CC} = 9.0V, Ta = 25°C) SW & VR MODE							MEASUREMENT METHOD
		SW 19, 20	SW33B	SW42	SW43	SW45	—		
31	TV↔EXT Crosstalk	C	A (TV) B (Ext)	A (Ext) B (TV)	A (Adj)	A (TV) B (Ext)	—		TV→EXT (1) Set : Ext mode (2) Pin 45 (TV input) : Input 3MHz, 1V_{p-p}, sine wave. (3) Measure the v_{40} TV : pin 40 signal amplitude (4) Calculate $v_{T\rightarrow E} = 20\ell og$ (v_{40}TV / 1.5V_{p-p}) EXT→TV (1) Set : TV mode (2) Pin 42 (Ext input) : Input 3MHz, 0.5V_{p-p} sine wave (3) Measure the v_{40} EXT : Pin 40 signal amplitude (4) Calculate $v_{E\rightarrow T} = 20\ell og$ (v_{40} EXT / 1.5V_{p-p})
32	TV→EXT Mode Switching Level	SW 19, 20	SW33B	SW42	SW43	SW45	Bright	—	(1) Pin 42 (Ext input) : Input 100kHz, 0.5V_{p-p}, sine wave (2) Pin 33 (Chroma input) : Impress the external voltage of 5V DC through 30kΩ resistance (3) Decrease the pin 33 external voltage from 5V DC. (4) Measure the pin 33 DC voltage just after the output signal appeared at pin 40.
		C	—	A	A (Max.)	B	—		

NOTE No.	ITEM	MEASUREMENT CONDITION (V_{CC} = 9.0V, Ta = 25°C) SW & VR MODE							MEASUREMENT METHOD
		SW 19, 20	SW33B	SW42	SW43	SW45	Bright	—	
33	EXT→TV Mode Switching Level	C	—	B	A (Max.)	A	—		(1) Pin 45 (TV input) : Input 100kHz, 1.0V_{p-p} sine wave (2) Pin 33 (Chroma input) : Impress the 0V external voltage through 30kΩ resistance. (3) Increase the external voltage from 0V. (4) Measure the pin 33 DC voltage just after the output signal appeared at pin 40.
34	AC Gain (Pin 42, 45→ Pin 34)			—	B	—			(1) Input 10kHz 0.4V_{p-p} sinewave to pin 45. (2) SW33B ; A, SW42 ; B, SW45 ; A (3) Measure V34T ; AC amplitude of pin 34. (4) G_{V2}^{TV} = V34T / 0.4 (5) Input 10kHz 0.2V_{p-p} sinewave to pin 42. (6) SW33B ; B, SW42 ; A, SW45 ; B. (7) Measure V34E ; AC amplitude of pin 34. (8) G_{V2}^{EXT} = V34E / 0.2
35	Brightness Control Adjust Voltage	SW19	SW20	SW36A	SW36B	SW37	Bright	—	(1) Pin 38 (Brightness control) : Adjust to make the Y output terminal (pin 16) output voltage during the trace period be 5.0V (2) Measure the pin 38 output voltage.
		C	C	B	B	C	Adj		

NOTE No.	ITEM	MEASUREMENT CONDITION (V_{CC} = 9.0V, Ta = 25°C) SW & VR MODE							MEASUREMENT METHOD
		SW19	SW20	SW36A	SW36B	SW37	Bright	—	
36	Brightness Control Sensitivity	C	C	B	B	C	Adj	—	(1) Same as (1) for note 34. (2) Higher the brightness terminal (pin 36) voltage by 0.5V. (3) Measure the V16 : Pin 16 output DC voltage. (4) Calculate the $G_{BR} = (V16 - 5) \times 2$.
37	Min. Linear Video Input (Pin 37) Max. Linear Video Input (Pin 37)								(1) Adjust the Brightness VR to make the video output (pin 16 output) during the trace period be 5V. (2) Vary the video input terminal (pin 37) DC voltage. (3) Measure the V_{di3} and V_{di4} in the fig. below. 
38	Video Input Dynamic Range (Pin 37)								(1) Same as (1) for note 36. (2) Same as (2) for note 36. (3) Same as (3) for note 36. (4) Calculate $V_{diB} = V_{di4} - V_{di3}$
39	Min. Output (Pin 37) Max. Output (Pin 37)								(1) Same as (1) for note 36. (2) Same as (2) for note 36. (3) Measure the V_{do4} and V_{do3} in fig. below. 

NOTE No.	ITEM	MEASUREMENT CONDITION (V_{CC} = 9.0V, Ta = 25°C)							MEASUREMENT METHOD
		SW & VR MODE							
		SW19	SW20	SW36A	SW36B	SW37	Bright	—	
40	Dynamic Range of 2nd-order Differential Video Input	C	C	A	B	C	Adj	—	(1) Adjust : Brightness control to make Y output (pin 16) output during the trace period be 3.8V (2) Set : Sharpness control (pin 36) voltage = 6.5V (3) Pin 36 (sharpness control) : Apply 2.4MHz, vary amplitude (4) Measure the V_{dip1} : Pin 36 input amplitude which make the upper side wave amplitude of pin 16 output be 80% of the maximum. (5) Adjust : Brightness control to make Y output (pin 16) output during the trace period be 5.6V (6) Pin 36 (sharpness control) : Apply 2.4MHz, vary amplitude (7) Measure the V_{dip2} : Pin 36 input amplitude which make the lower side wave amplitude of pin 16 output be 80% of the maximum. (8) V_{dip} = min (V_{dip1}, V_{dip2})
41	AC Gain (Pin 37→ Pin 16)			B	A (Max.)	B			(1) Adjust : Brightness VR to make the Y output (pin 16) output be 4V (2) Pin 37 (video input) : Input 10kHz, 0.5V_{p-p} (3) Measure the v16 : Pin 16 output amplitude

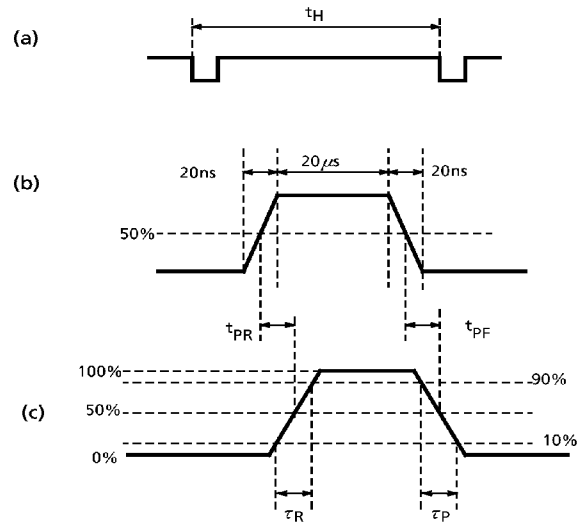
NOTE No.	ITEM	MEASUREMENT CONDITION (V_{CC} = 9.0V, Ta = 25°C)							MEASUREMENT METHOD
		SW & VR MODE							
		SW19	SW20	SW36A	SW36B	SW37	Bright	—	
42	Frequency Characteristics (Pin 37→ Pin 16)	C	C	B	A (Max.)	B	Adj		(1) Same as (1) for note 40. (2) Video input (pin 37) : Input 0.5V_{p-p}, 100kHz and 6MHz. (3) Same as (3) for note 40. (4) Calculate G_P^B $= 20\ell og\left(v_{16}^{6MHz} / v_{16}^{100kHz}\right)$
43	Gain Variation (min. sharpness)				A (Adj)			—	(1) Same as (1) for note 40. (2) Video input (pin 37) : Input 0.5V_{p-p}, 2.4MHz (3) Measure the pin 16 output amplitude at picture sharpness VR (pin 36) max and min. (4) ΔG_{PS}^{MIN} $= 20\ell og\ (v_{16MIN} / v16MAX)$
44	Gain of Picture Sharpness Control			A B	A (Max.)	C B			(1) Same as (1) for note 40. (2) Pin 36 (sharpness control) : Input 2.4MHz, 0.1V_{p-p} (3) Measure the v_{16} sharp : Pin 16 voltage (4) Pin 37 (Video input) : Input 2.4MHz, 0.1V_{p-p} (5) Measure the v_{16} main : Pin 16 voltage (6) Calculate G_{PS} $= 20\ell og\ (v_{16}$ sharp / v_{16} main)

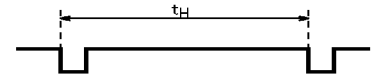
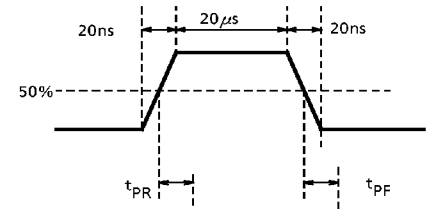
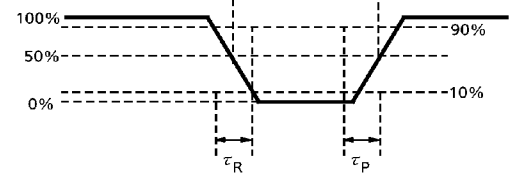
NOTE No.	ITEM	MEASUREMENT CONDITION (V_{CC} = 9.0V, Ta = 25°C) SW & VR MODE							MEASUREMENT METHOD
		SW19	SW20	SW36A	SW36B	SW37	Bright	—	
45	Picture Sharpness Control Characteristics	C	C	B	B	B	Adj		(1) Same as (1) for note 40. (2) Pin 37 (Video in) : Input 0.5V_{p-p}, 100kHz and 2.4MHz (3) Measure the $v_{16}^{2.4MHz}$, v_{16}^{100kHz} : Pin 16 output voltage (4) Calculate $G_{PS}^{o} = 20\ell og\left(v_{16}^{2.4MHz} / v_{16}^{100kHz}\right)$
46	Picture Sharpness Control Range			A B	A (Adj)	C B		—	(1) Same as (1) for note 40. (2) Pin 36 (Sharpness control) : Input 2.4MHz, 0.1V_{p-p} Pin 37 (Video in) : AC ground (3) Change : Sharpness VR from min to max Measure $\left(V_{36}^{H}\right)$: pin 36 DC voltage to make the pin 16 output be 90% of the one at the V_R max. (4) Pin 37 (Video in) : Input 2.4MHz, 0.5V_{p-p} Pin 36 (Sharpness control) : AC ground (5) Measure V_{36}^{L} : By same way as (3) but 10% (6) Calculate : $\Delta V_{PS} = V_{36}^{H} - V_{36}^{L}$ 

NOTE No.	ITEM	MEASUREMENT CONDITION (V_{CC} = 9.0V, Ta = 25°C)							MEASUREMENT METHOD
		SW & VR MODE							
		SW19	SW20	SW36A	SW36B	SW37	Bright	—	
47	V-BLK Pulse Output Level	C	C	B	B	C	Adj	—	Measure the Yout (pin 16) output V-blanking voltage.
48	Y Output Drive Current								(1) Same as (1) for note 40. (2) Pin 16 : Connect to V_{CC} through 1kΩ resister (3) Measure $V_{\#16}$: Pin 16 output voltage during the trace period (4) Calculate : $I_{\#16} = \frac{V_{CC} - V_{\#16}}{1}$ (mA)

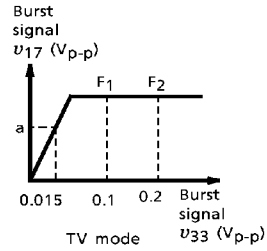
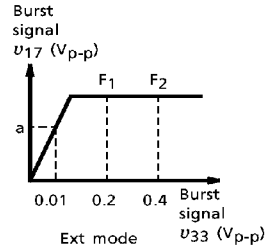
OSD interface stage

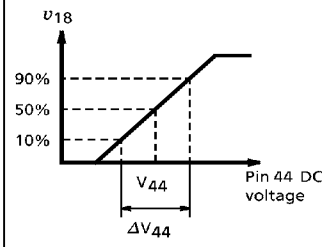
NOTE No.	ITEM	MEASUREMENT CONDITION (V_{CC} = 9.0V, Ta = 25°C) SW & VR MODE SW35		—	MEASUREMENT METHOD
49	OSD Output DC Voltage	C			(1) Apply external voltage 4.3V to pin 33. (2) Apply external voltage 5V to pin 29. (3) Measure DC voltage. Pin 15 : V^{L}_{OUTR} Pin 17 : V^{L}_{OUTG} Pin 18 : V^{L}_{OUTB} (4) Measure picture period voltage. Pin 16 : V^{L}_{OUTV} (5) Apply external voltage 5V to pin 19 and measure picture period voltage of pin 16 and DC voltage of pin 17, 18. (6) Apply external voltage 5V to pin 20 and measure picture period voltage of pin 16 and DC voltage of pin 15, 18. (7) Apply external voltage 5V to pin 28 and measure picture period voltage of pin 16 and DC voltage of pin 15, 17.
50	OSD Output Hi Voltage	C			(1) Apply external voltage 5V to pin 19. (2) Measure DC Voltage of pin 15 ; V^{H}_{OUTR} (3) Apply external voltage 5V to pin 20. (4) Measure DC voltage of pin 17 ; V^{H}_{OUTG} (5) Apply external voltage 5V to pin 28. (6) Measure DC voltage of pin 18 ; V^{H}_{OUTB}
51	ROSD Threshold Voltage	C			(1) Apply external voltage to pin 19, raise it from 0V. (2) Measure pin 19 voltage to change pin 15 DC voltage.
52	GOSD Threshold Voltage	C			(1) Apply external voltage to pin 20, raise it from 0V. (2) Measure pin 29 voltage to change pin 17 DC voltage.

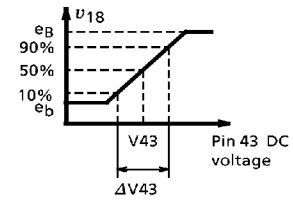
NOTE No.	ITEM	MEASUREMENT CONDITION (V_{CC} = 9.0V, Ta = 25°C)			
		SW & VR MODE			MEASUREMENT METHOD
		SW35		—	
53	BOSD Threshold Voltage	C			(1) Apply external voltage to pin 28, raise it from 0V. (2) Measure pin 28 voltage to change pin 18 DC voltage.
54	YS Threshold Voltage	C			(1) Apply external voltage to pin 29, raise it from 0V. (2) Measure pin 29 voltage to change pin 18 DC voltage.
55	Output High Level Rise Time	C			(1) ROSD in (pin 19) : Input signal (b), $5V_{p-p}$. (2) Measure τ_R, t_{PR}, τ_P, t_{PF} in fig. (c) with R-Y output (pin 15). (3) Same for GOSDin (pin 20), G-Y output (pin 17). (4) Same for BOSDin (pin 28), B-Y output (pin 18). 
	Output High Level Propagation Delay Time (Rising Edge)	C			
	Output High Level Fall Time	C			
	Output High Level Propagation Delay Time (Falling Edge)	C			

NOTE No.	ITEM	MEASUREMENT CONDITION (V_{CC} = 9.0V, Ta = 25°C)			MEASUREMENT METHOD
		SW & VR MODE			
		SW35		—	
56	Output Low Level Rise Time	C			(1) Adjust brightness VR to make 5V picture period voltage at pin 16. (2) Apply 5V to pin 29. Adjust OSD brightness VR to make 4V picture period voltage at pin 16. (3) ROSD in (pin 19) : Input signal (b), $5V_{p-p}$. (4) Measure τ_R, t_{PR}, τ_F, t_{PF} in fig (c) with pin 16, 17, 18. (5) Input sig (b) 20, measure with pin 15, 16, 18. Input sig (b) 28, measure with pin 15, 16, 17. Input sig (b) 29, measure with pin 15, 16, 17, 18. (a)  (b)  (c) 
	Output Low Level Fall Time	C			
	Output Low Level Propagation Delay Time (Rising Edge)	C			
	Output Low Level Propagation Delay Time (Falling Edge)	C			

Chroma stage

NOTE No.	ITEM	MEASUREMENT CONDITION (V_{CC} = 9.0V, Ta = 25°C) SW & VR MODE											MEASUREMENT METHOD
		12	32	33A	33B	34	36	42	43	44	45	46	
57	ACC Characteristics	A	A	B ↓ A	A (TV) B (Ext)	OFF	OFF	B (TV) A (Ext)	B Set to 2.0V	—	A (TV) B (Ext)	C ↓ B	(1) Pin 33 : Input rainbow color bar   (2) Measure a, Calculate A $A = \frac{F_2}{F_1}$ (Note 1) Input video signal (sync signal) is to be selected subject to the mode (TV, Ext). (Note 2) Unused pin is to be grounded through capacitance.

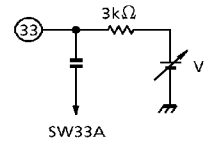
NOTE No.	ITEM	MEASUREMENT CONDITION (V_{CC} = 9.0V, Ta = 25°C) SW & VR MODE 12	32	33A	33B	34	36	42	43	44	45	46	MEASUREMENT METHOD
58	Color Control Voltage	A	A	B ↓ A	A	OFF	OFF	B	A (Min)	A (Adj)	A	A (Adj)	(1) Pin 33 : Input rainbow color bar 0.15V_{p-p} (2) Vary : Color Control (pin 44) Monitor : B-Yout (pin 18) (3) Measure V_{44}. Calculate ΔV_{44}.  (4) Tint control is to be center. (5) Pin 44 is to be grounded through capacitance in TV mode.
	Color Control Range												

NOTE No.	ITEM	MEASUREMENT CONDITION (V_{CC} = 9.0V, Ta = 25°C)											MEASUREMENT METHOD
		SW & VR MODE											
		12	32	33A	33B	34	36	42	43	44	45	46	
59	Uni-color Control Gain Variation Range	A	A	B ↓ A	A	OFF	OFF	B	A (Adj)	B	A	A (Adj)	(1) Same as (1) for note 58. (2) Vary : Contrast control (pin 43) Monitor the B-Yout (pin 18) (3) Measure V43. Calculate ΔV43. (4) Same as (4) for note 58. (5) Same as (5) for note 58. (6) Calculate : $e_u = 20\ell og\left(\frac{e_B}{e_b}\right)$ (dB) 
	Uni-color Control Adjust. Voltage												
	Uni-color Control Adjust. Voltage Range												
60	Chroma Input Terminal Voltage			B	A ⇵ B				C		B	B	Measure : Pin 33 DC voltage for TV mode / Ext mode each.

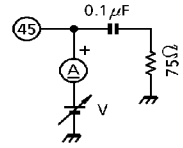
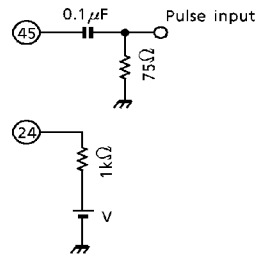
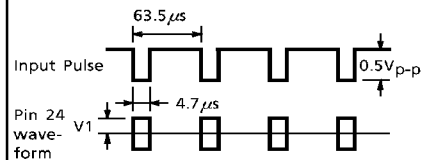
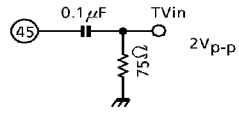
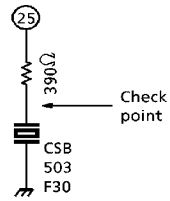
NOTE No.	ITEM	MEASUREMENT CONDITION (V_{CC} = 9.0V, Ta = 25°C) SW & VR MODE 12	32	33A	33B	34	36	42	43	44	45	46	MEASUREMENT METHOD
61	Tint Control Range (Part)	A	A	A	A	OFF	OFF	B	A (Min)	B	A	A (Adj)	(1) Pin 33 (Chroma in) : Input 3.58MHz, 150mV_{p-p} (2) Vary : Tint control (pin 46) Monitor : B-Yout (pin 18) Find tint center : The point make B-Y output max Measure : the output at max tint control, min tint control. Calculate variable phase angle.
62	Tint Control Voltage Tint Control Voltage Range												(1) Same as (1) for note 61. (2) Measure terminal voltage at pin 46, which gives 10%~90% of Tint control range (ΔV_{46}). (3) Measure terminal voltage at pin 46, which gives 50% of Tint control range (V_{46}).
63	Frequency Control Sensitivity	B (Adj)		B					C			C Set to 1.3V	Monitor : The signal frequency at B-Yout (pin 18) Vary : Apply DC voltage to APC terminal (pin 12) Calculate : The frequency control sensitivity around f_{sc} : 3.579545MHz

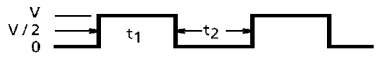
NOTE No.	ITEM	MEASUREMENT CONDITION (V_{CC} = 9.0V, Ta = 25°C) SW & VR MODE											MEASUREMENT METHOD
		12	32	33A	33B	34	36	42	43	44	45	46	
64	APC Pull-in, Hold Range	A	A	A	A	OFF	OFF	B	A (Min)	B	A	C Set to 1.3V	Pin 33 (Chroma in) : Input 0.15V_{p-p} (frequency : Vary) Check : Pull in range (Color control pin 44 "H" at pull in)
65	Killer Operation Input Level				A or B			B or A		A	A or B	B	(1) Pin 33 (Chroma in) : Input 50mV_{p-p} Burst signal Attenuate : Burst signal with attenuater. Measure : Burst level which make pin 44 (Color control) be "L". (2) Same as (2) for note 57.
66	Demodulation Output DC Voltage				A			B		A (Min)	A		(1) Pin 33 (Chroma in) : Input 0.15V_{p-p} rainbow color bar (2) Minimize : Color control (pin 44) Measure : The color differential output (pin 15, 17, 18) DC voltage
67	Color Differential Output					OFF	OFF			A (Max)		A (Adj)	(1) Same as (1) for note 66. (2) Measure : The each axis max in tint control varing

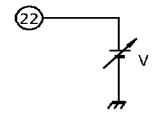
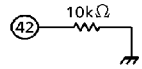
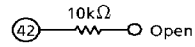
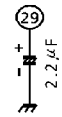
NOTE No.	ITEM	MEASUREMENT CONDITION (V_{CC} = 9.0V, Ta = 25°C)											MEASUREMENT METHOD
		SW & VR MODE											
		12	32	33A	33B	34	36	42	43	44	45	46	
68	Max. Color Difference Output	A	A	A	A	OFF	OFF	B	A (Max)	A (Max)	A	A (Adj)	(1) Pin 33 (Chroma in) : Input rainbow color bar (Burst level 250mV$_{p-p}$) with "Burst : Chroma = 1 : 2.5" (2) Same as (2) for note 67.
69	Relative Amplitude								A (Min)				(1) Same as (1) for note 66. (2) Measure : The each axis max. in hue control (pin 46) varing. Calculate based on B-Y.
70	Relative Phase												(1) Pin 35 (Chroma in) : Input 0.15V$_{p-p}$ sine wave. (2) Adjust tint control (pin 46) so that the (B-Y) output is the maximum. (3) Adjust tint control so that the (R-Y), (G-Y) outputs are the minimum, and measure (B-Y) output amplitude. (4) Calculate the ratio (x) of (B-Y) outputs from (2) and (3). (5) R-Y $90° + \cos^{-1}x$ G-Y $360° - (90° + \cos^{-1}x)$

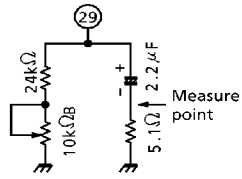
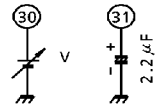
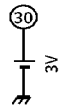
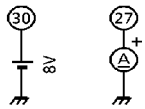
NOTE No.	ITEM	MEASUREMENT CONDITION (V_{CC} = 9.0V, Ta = 25°C) SW & VR MODE											MEASUREMENT METHOD
		12	32	33A	33B	S sw	36	42	43	44	45	46	
71	Demodulation Output Residual Carrier	A	A	A	A	OFF	OFF	B	C	A (Min)	A	A (Adj)	(1) Vary tint control (pin 46). Measure the max. amplitude of residual carrier wave for color differential output. (2) Same as (1) for note 66.
72	Demodulation Output Residual Harmonics								A (Adj)	A (Max)		B	(1) Same as (1) for note 66. (2) Set : B-Yout (pin 18) amplitude = 1V_{p-p} Measure : The level of higher harmonic in color differential output.
73	S-VHS SW Threshold Voltage								A (Max)	B	B		(1) Connect external power suply via 3kΩ and adjust the voltage to make pin 33 DC voltage be 2.6V. (2) Input rainbow color bar signal 10mV_{p-p} (ACC Max sensitivity). (3) Monitor pin 18 B-Y out. Reduce external power supply voltage. Measure pin 33 DC voltage to raise B-Y amplitude. 

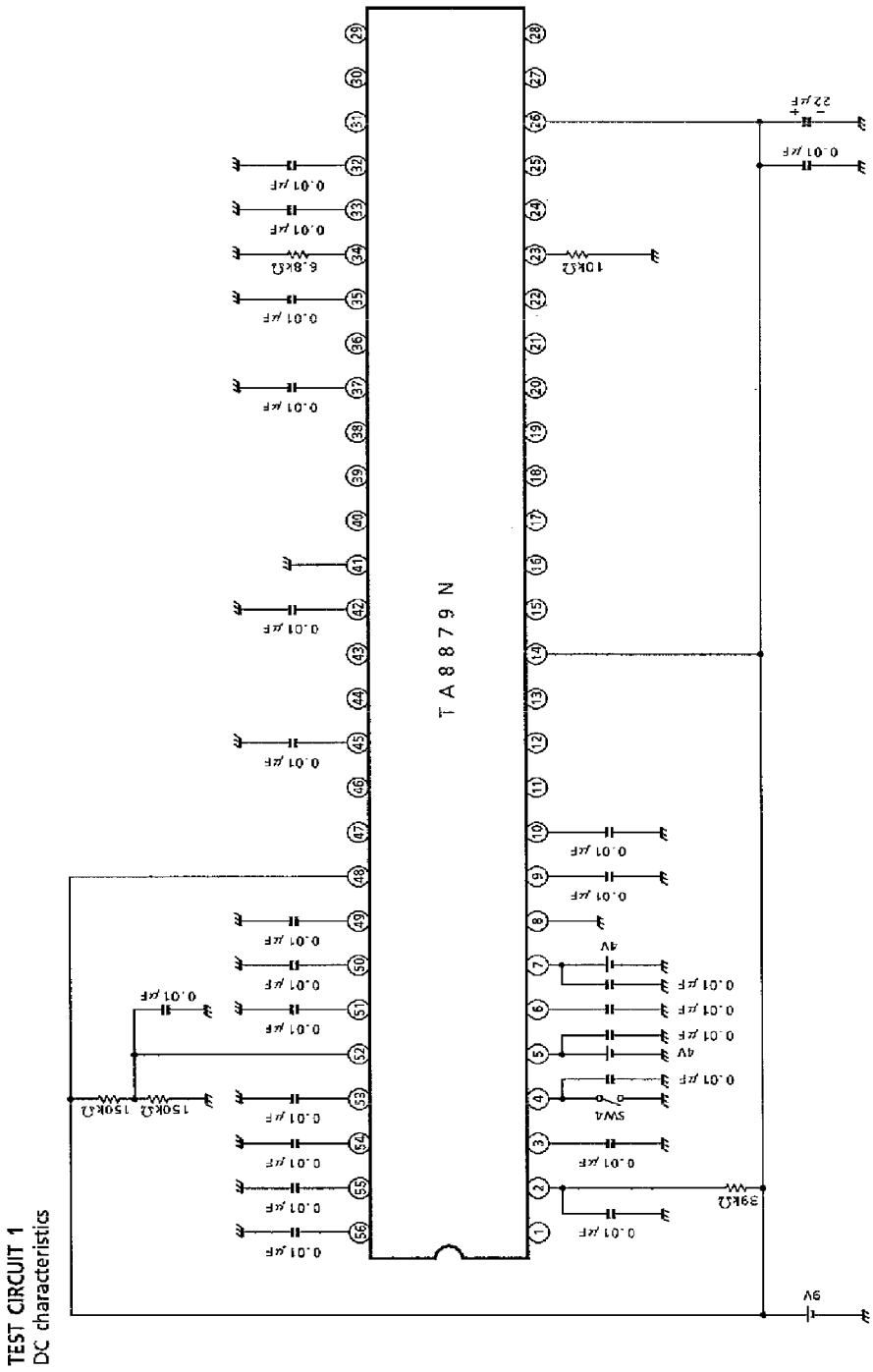
Deflection stage

NOTE No.	ITEM	MEASUREMENT CONDITION (V_{CC} = 9.0V, Ta = 25°C) SW & VR MODE SW24	SW26	SW33	—	MEASUREMENT METHOD
74	Sync Separation Input Current Sensitivity	ON	ON	OFF		(1) Decrease : External voltage V from 3V to turn the frequency at pin 31 from 297H to 232.25H (2) Measure : Ampere meter Ⓐ
75	AFC Phase Detection Current	OFF	OFF			(1) Set : External voltage V to the voltage at pin 24 open (≒7.2V) (2) Input : Pin 45, fig. below (3) Monitor : Pin 24 (4) Calculate $I_{DET} = \frac{V1\ (mV)}{1\ (k\Omega)}$ 
76	Phase Detection Masking Period	ON	ON			(1) Input : TV signal of field frequency 60Hz (2) Monitor : Pin 24 (3) Measure : Mask period : H.AFC phase det. stop period
77	$32f_H$ VCO Oscillation Start Voltage					(1) Set : H.V_{CC} = 4V (2) Pin 14 : No power supply (3) Check : OSC at the check point

NOTE No.	ITEM	MEASUREMENT CONDITION (V_{CC} = 9.0V, Ta = 25°C)				
		SW & VR MODE				MEASUREMENT METHOD
		SW24	SW26	SW33	—	
78	Horizontal Output Start Voltage	ON	ON	OFF	—	(1) Vary : H.V_{CC} (2) Pin 14 : No power supply (3) Measure : H.V_{CC} which make H.pulse be appeared at pin 23.
79	Horizontal Free-running Frequency				—	Measure : OSC frequency at pin 23
80	Horizontal Frequency Control Range				—	(1) Pin 24 : Ground through 68kΩ resistance (2) Measure : The f_{max} : OSC frequency at pin 23 (3) Pin 24 : Connect to H.V_{CC} through 10kΩ resistance (4) Measure : the f_{min} : OSC frequency at pin 23
81	Horizontal Frequency Control Sensitivity				—	(1) Sweep : Pin 24 voltage ±0.05V against the voltage which make the H OSC frequency = 15.734kHz (2) Measure, Calculate : OSC frequency changing at pin 23
82	Horizontal Output Duty Ratio				—	(1) Monitor : Pin 23 (2) Calculate T_{o23}  $T_{o23} = \frac{t_1}{t_1 + t_2} \times 100\ (\%)$

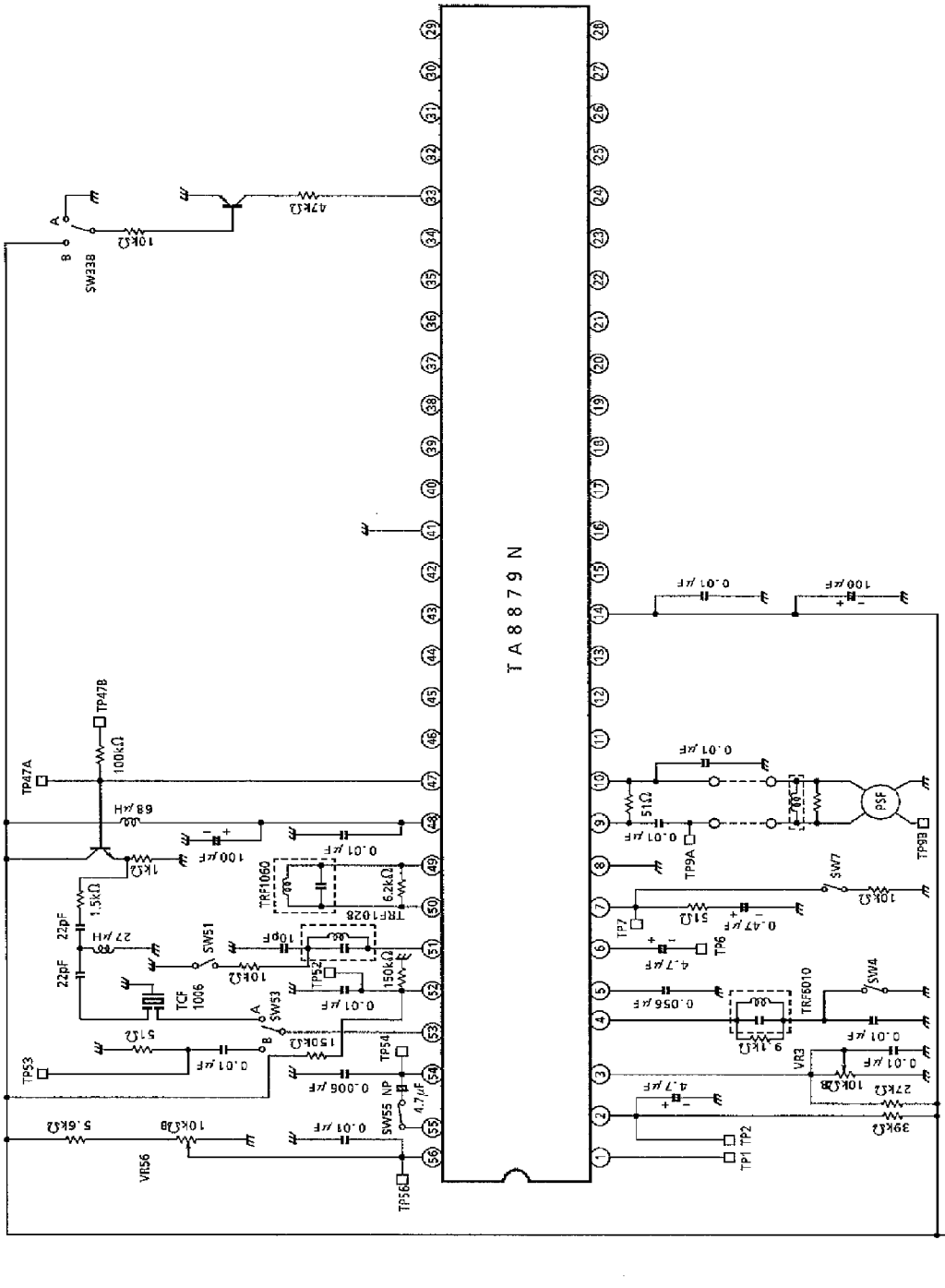
NOTE No.	ITEM	MEASUREMENT CONDITION (V_{CC} = 9.0V, Ta = 25°C) SW & VR MODE				MEASUREMENT METHOD
		SW24	SW26	SW33	—	
83	Horizontal Output Voltage	ON	ON	OFF	—	(1) Monitor : Pin 23 Measure V_{H23} : Voltage during "H" period (2) Measure V_{L23} : Voltage during "L" period
84	X-ray Protection Threshold Voltage					(1) Increase : external voltage V to make the waveform at pin 23 be disappeared ("L" state) (2) V_{I22} = V
85	X-ray Protection Hold Voltage				—	(1) Same as note 84 to make the pin 23 be "L". (at SW26 ON) (2) SW26 : OFF (3) H. V_{CC} = 2.5V SW26 : ON H.V_{CC} = 9V Check : Pin 23 is "L" for each
86	Vertical Output Pulse Width			ON		(1) Monitor : Waveform at pin 31 (2) Calculate : T_{r1} 
						(1) Monitor : Waveform at pin 31 (2) Calculate : T_{r1}
87	Ramp Max. Output Voltage			OFF		Measure the pin 31 DC voltage

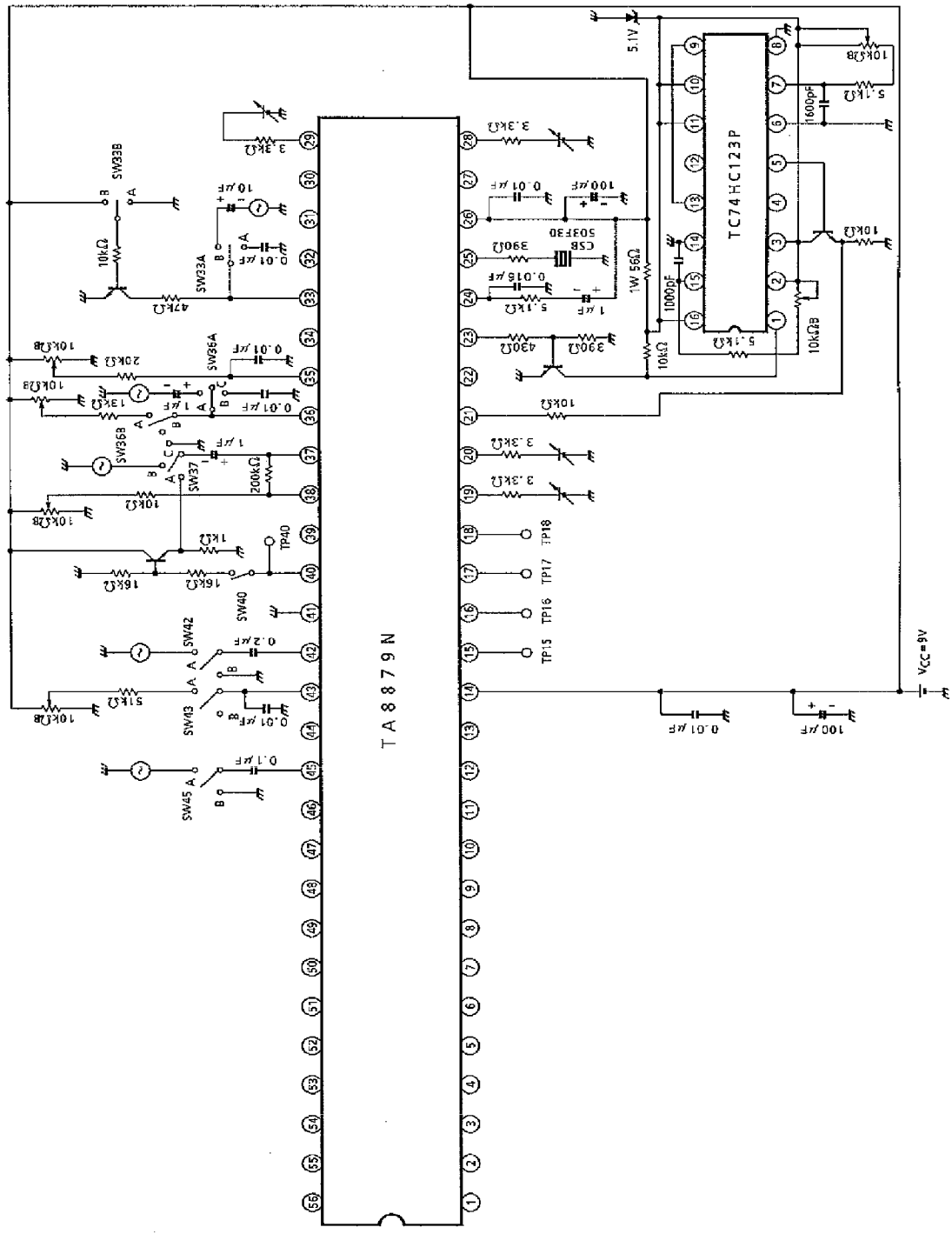
NOTE No.	ITEM	MEASUREMENT CONDITION (V_{CC} = 9.0V, Ta = 25°C)				
		SW & VR MODE				MEASUREMENT METHOD
		SW24	SW26	SW33	—	
88	Ramp Max. Output Current	ON	ON	OFF		(1) Measuring point : Monitor the waveform at this point (2) Calculate I_{O31} (mA) $= \frac{V\ (mV)}{5.1\ (\Omega)}$ 
89	Vertical Amplifier Gain					(1) Measure : Pin 27 output voltage vs pin 30 applied DC voltage V (2) Calculate : G_V
90	Vertical Output Max. Voltage					(1) Pin 30 : Impress 8V (2) Measure : Pin 27 voltage
91	Vertical Output Min. Voltage					Same as note 88 but pin 30 3V.
92	Vertical Output Max. Current					(1) Pin 30 : 8V (2) Measure : Pin 27 output current
93	Pull-in Range of Vertical Oscillator				—	(1) Sweep : Vertical sync frequency of input video signal by 0.5H step (2) Measure : Vertical pull-in range



TEST CIRCUIT 1
DC characteristics

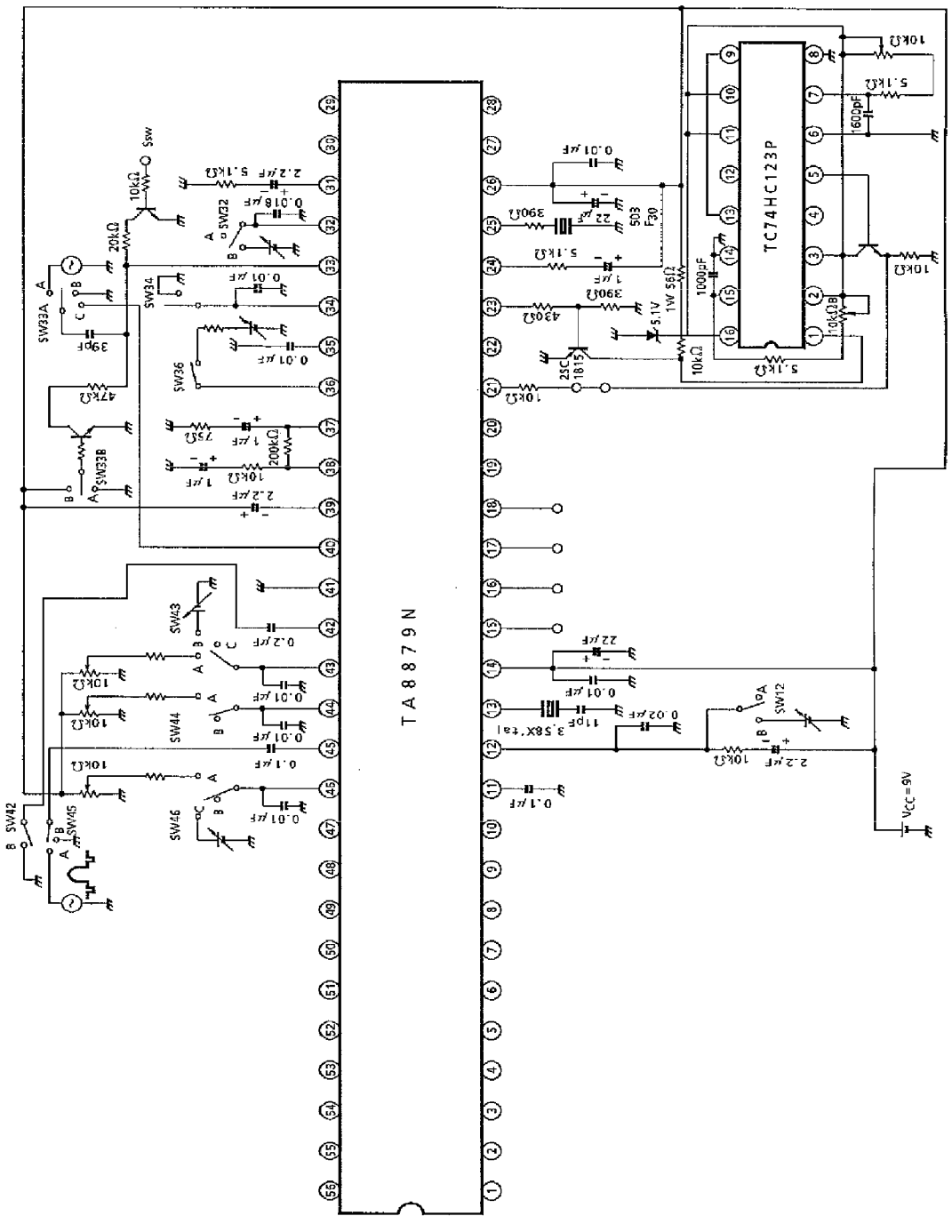
TA8879N – 54





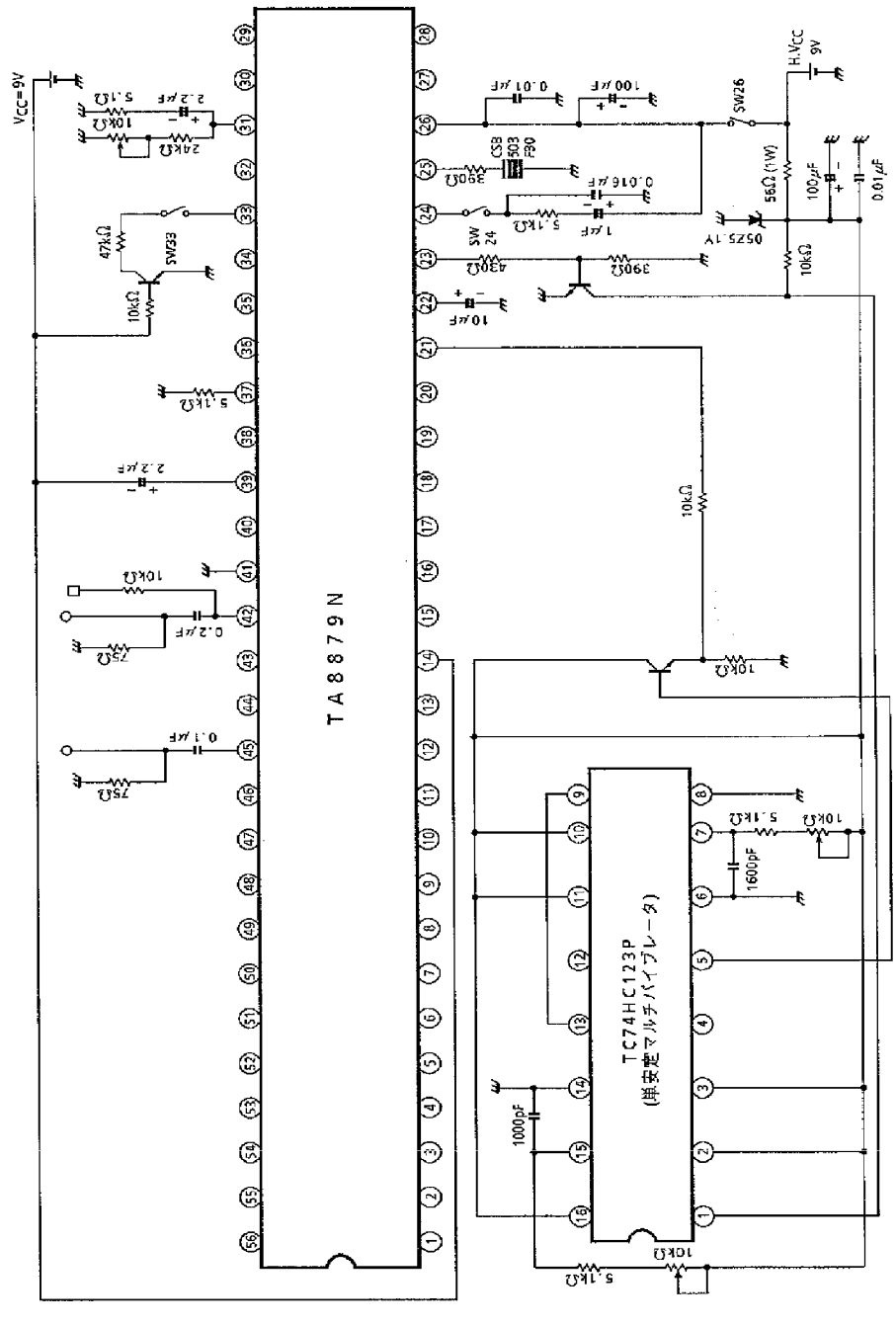
TEST CIRCUIT 3
Video, OSD interface stage

TA8879N – 56



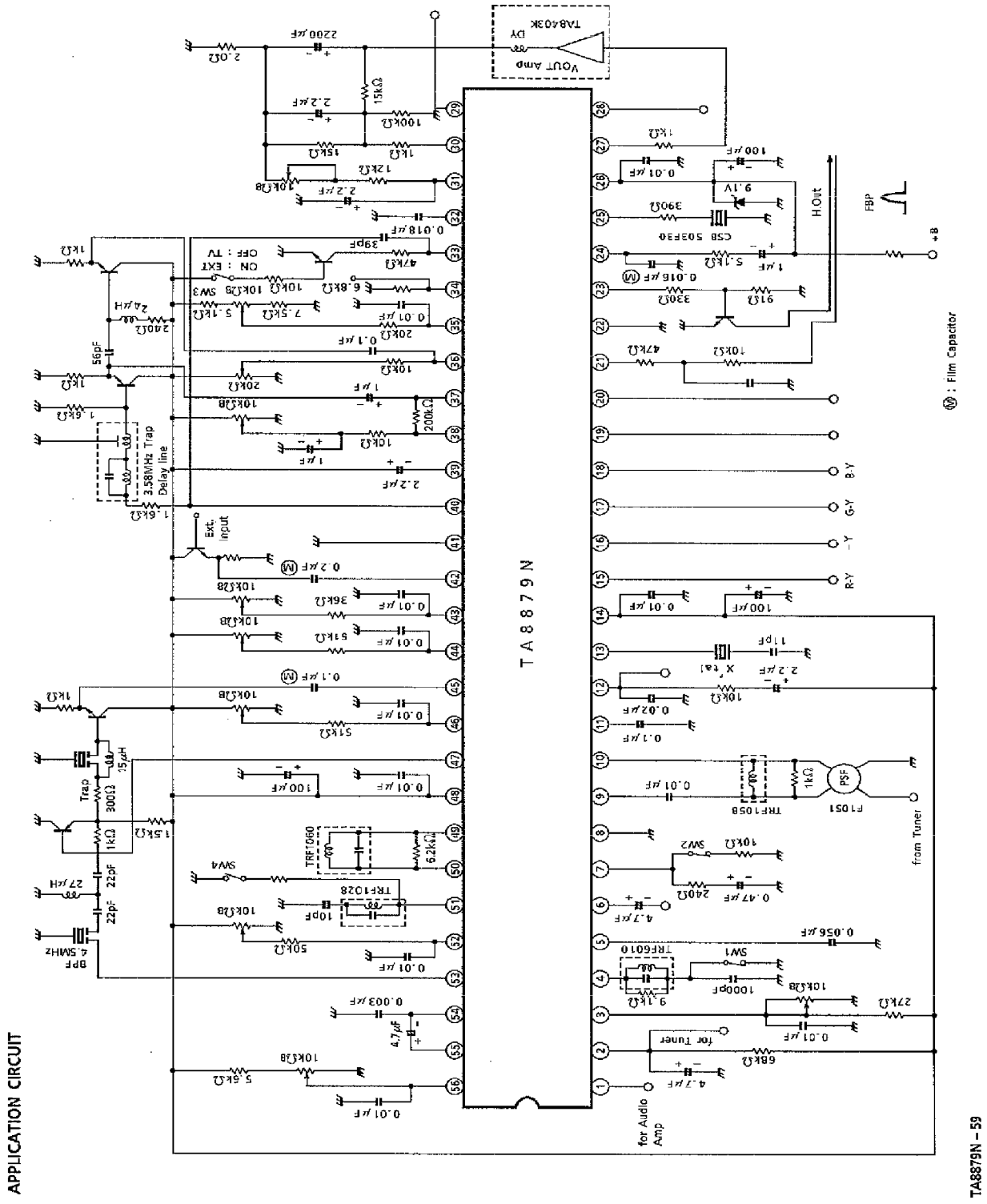
TEST CIRCUIT 4
Chroma stage

TA8879N – 57



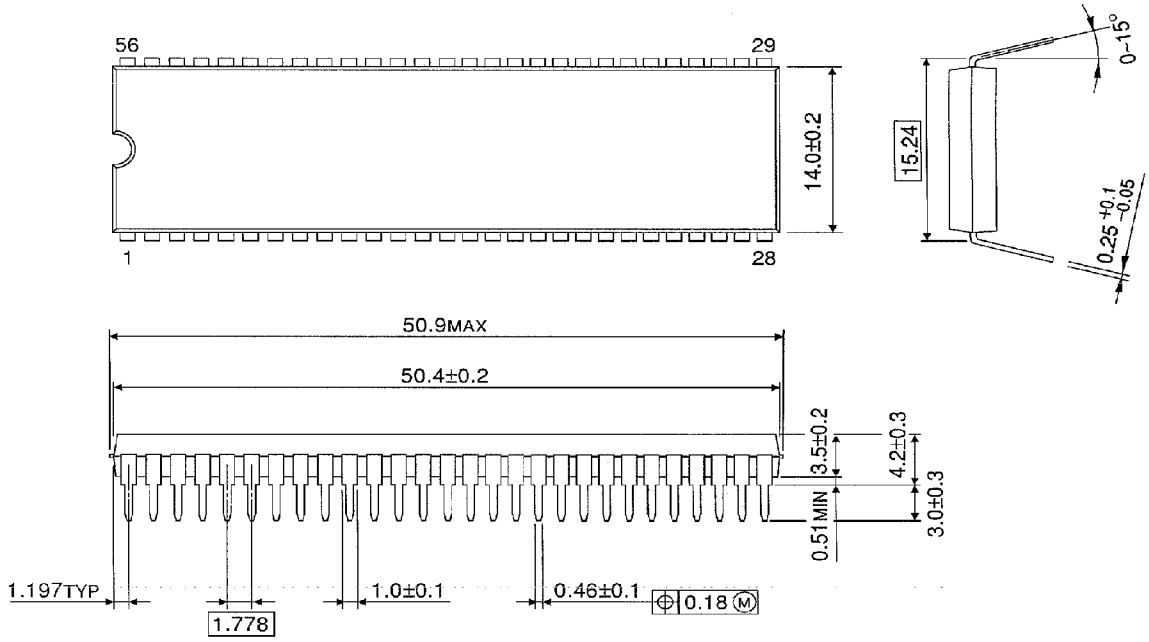
TEST CIRCUIT
Defrection stage

TA8879N – 58



OUTLINE DRAWING

SDIP56-P-600-1.78 Unit : mm



Weight : 5.55g (Typ.)