TA7680AP, TA7681AP

TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT

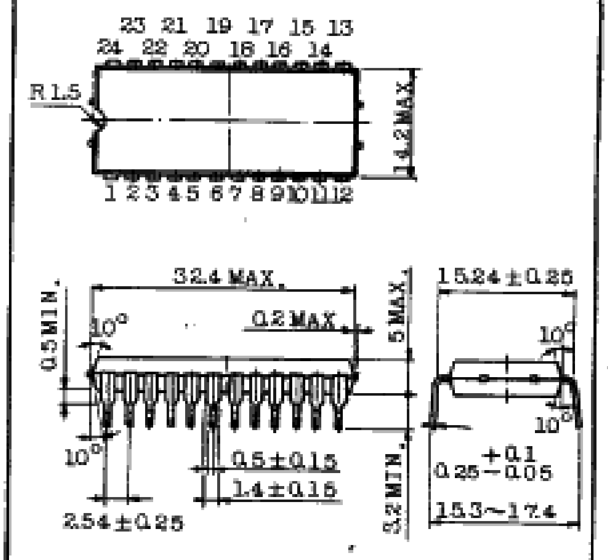
SILICON MONOLITHIC

TELEVISION PIF + SIF SYSTEM

TA7680AP....FOR FET TUNER

TA7681AP....FOR NPN TUNER

Unit in mm



Lead pitch is 2.54 and tolerance is ±0.25 against theoretical center of each lead that is obtained on the basis of No.1 and No.24 leads.

JEDEC	—
TOSHIBA	5−32A

FUNCTIONS

PIF

- Three Controlled IF Amplifier Stages
- Video Demodulator Controlled by Picture Carrier
- Black Noise and White Noise Inverter
- Peak AGC
- DC Amplifier for RF AGC Out

SIF

- Three Differential IF Amplifier Stages
- Phase Detector
- DC Controlled Attenuator
- Audio Amplifier Stage with NFB Terminal

FEATURES

- PIF, SIF, ATT AUDIO DRIVER
- 2 Chip Color TV System is Possible with TA7644BP

PIF

- High Gain, Wide Band IF Amplifier
- AGC Characteristics with Excellent Stability
- Excellent DG/DP Characteristics
- Excellent S/N Characteristics Due to Delayed 3 Stages AGC Action
- Negative Video Output Signal
- Switch Off the Video Part with VTR SW

SIF

- Excellent Limitter Characteristics
- Excellent Attenuator Characteristics

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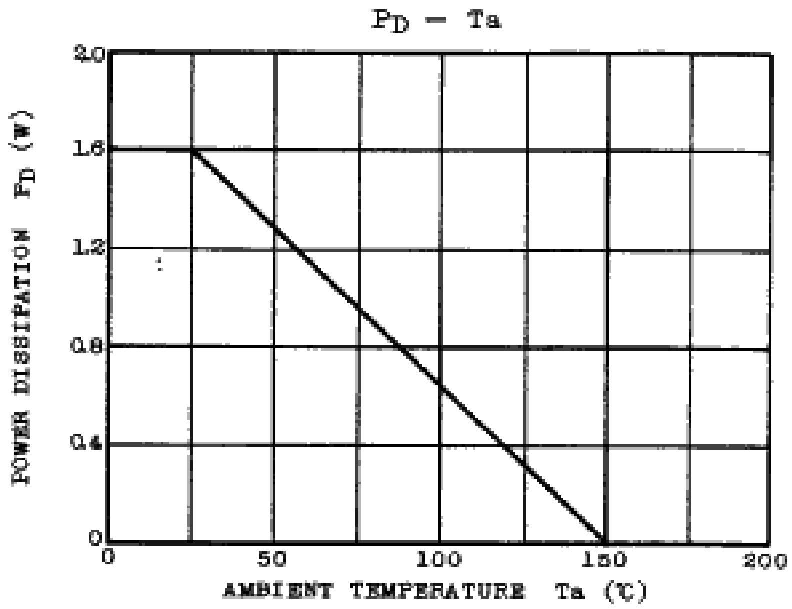
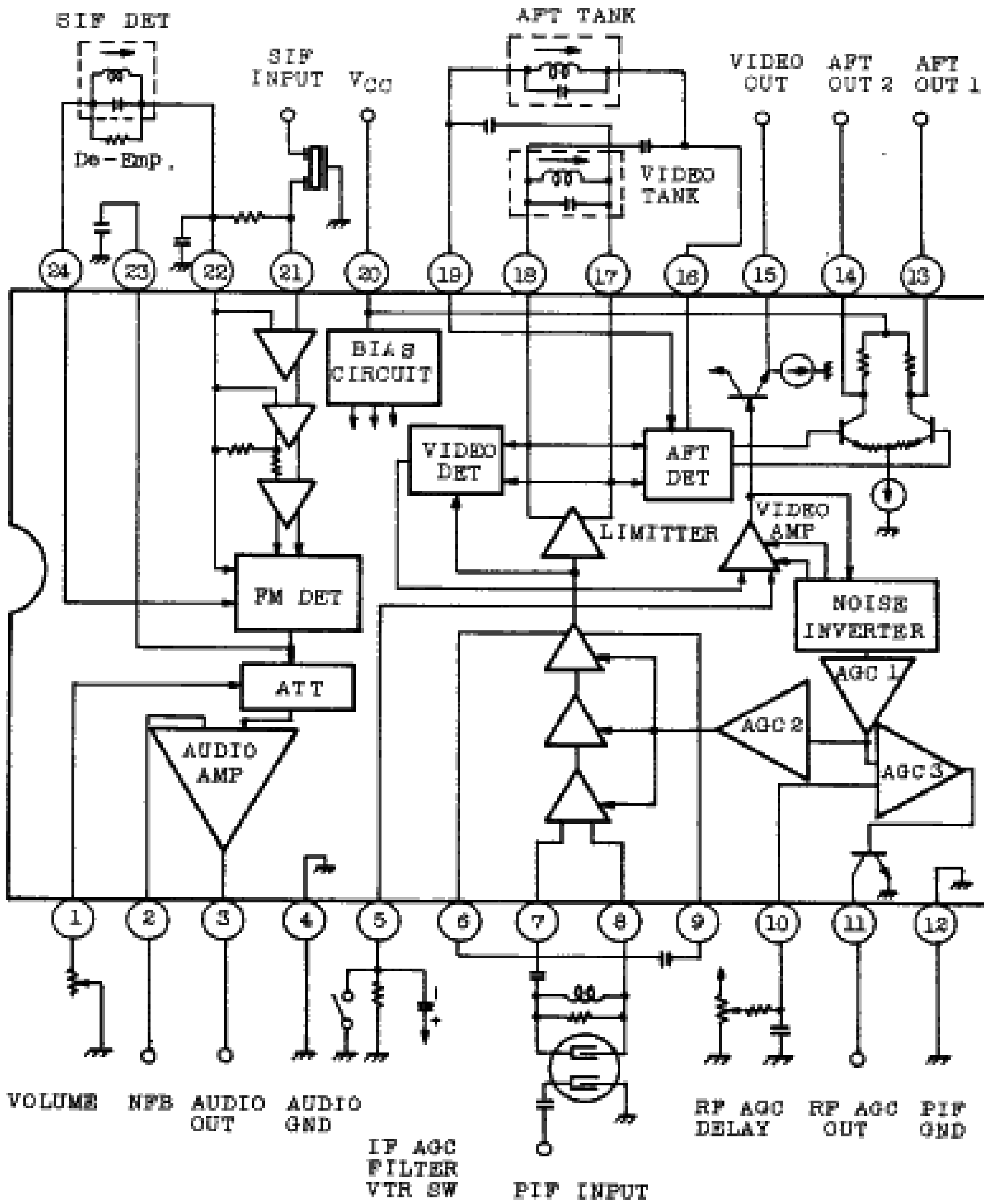
MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage	V_{CC}	15	V
Terminal 11 Open Voltage	V_{11}	15	V
Video DC Output Current	I_{15}	6	mA
Audio DC Output Current	I_3	3	mA
Terminal 2 Voltage	V_2	15	V
Power Dissipation (Note)	P_D	1.6	W
Operating Temperature	T_{opr}	-20 ~ 65	°C
Storage Temperature	T_{stg}	-55 ~ 150	°C

Note : Derated above Ta=25°C in the proportion of 12.8mW/°C.



BLOCK DIAGRAM



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ELECTRICAL CHARACTERISTICS ($Ta=25^{\circ}C$, $V_{CC}=12V$, $f_P=58.75MHz$, $f_S=54.25MHz$)

PIF SECTION

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Recommended Supply Voltage	V_{CC}	-	-	10.8	12.0	13.2	V
Supply Current	I_{CC}	1	-	50	72	95	mA
Video DC Output Voltage	V_{15}	1	SW_1:1(TA7680AP) 2(TA7681AP) SW_2:2	5.2	5.5	5.8	V
AFT DC Output Voltage	V_{13}	1	SW_1:1(TA7680AP) 2(TA7681AP) SW_2:2	5.3	6.8	8.3	V
	V_{14}	1	SW_1:1(TA7680AP) 2(TA7681AP) SW_2:2	5.3	6.8	8.3	V
AFT DC Offset Voltage	ΔV_{13-14}	1	SW_1:1(TA7680AP) 2(TA7681AP) SW_2:2	-1.5	0	1.5	V
RF AGC Residual Output Voltage	$V_{11\ SAT}$	1	SW_1:1(TA7680AP) 2(TA7681AP) SW_2:2	-	-	0.5	V
RF AGC Leak Current	$I_{11\ LEAK}$	1	SW_1:1(TA7681AP) 2(TA7680AP) SW_2:1	-	-	1	μA
Video Sensitivity	v_i PIN7-8	2	(Note 1)	60	150	250	μV_{rms}
AGC Range	ΔA_{PIF}	2	(Note 2)	60	64	-	dB
Sync Tip Level Voltage	V_{SYNC} (V_{15})	2	(Note 3)	2.3	2.5	2.7	V
Max. IF Input Voltage	$v_{IN\ MAX}$ PIF	2	(Note 4)	100	120	-	mV_{rms}
White Noise Threshold Level	V_{WTH} (V_{15})	2	(Note 5)	5.8	6.2	6.6	V
White Noise Clamp Level	V_{WCL} (V_{15})	2	(Note 5)	3.7	4.1	4.5	V

CHARACTERISTIC		SYMBOL	TEST CIR-CUIT	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Black Noise Threshold Level		$V_{B\ TH}$ (V_{15})	2	(Note 5)		1.4	1.6	1.8	V
Black Noise Clamp Level		$V_{B\ CL}$ (V_{15})	2	(Note 5)		2.9	3.3	3.7	V
Video Frequency Response		f_{BW}	3	(Note 6)		4.5	5.5	-	MHz
Suppression of Carrier		CL	4	(Note 7)		40	50	-	dB
Suppression of 2nd Carrier		I_{2nd}	4	(Note 8)		40	50	-	dB
920kHz Beat Level		I_{920}	4	(Note 9)		33	38	-	dB
Differential Phase		DP	5	(Note 10)		-	3.5	5	deg
Differential Gain		DG	5	(Note 10)		-	7	10	%
PIF Input Impedance		$R_{IN(PIF)}$	6	(Note 11)		1.5	3.0	6.0	kΩ
		$C_{IN(PIF)}$				-	3.0	10.0	pF
AFT Sensitivity		$\Delta F/V_{13-14}$	2	(Note 12)		-	16	-	kHz/V
AFT Output Voltage	Upper	V_{13U} V_{14U}	2	(Note 13)		11.7	11.9	1.20	V
	Lower	V_{13L} V_{14L}	2	(Note 13)		1.8	2.3	2.8	V
RF AGC Max. Available Current		$I_{4\ MAX}$	1	TA7680AP	SW_1:1 SW_2:1	0.3	-	-	mA
				TA7681AP	SW_1:2 SW_2:1	7.0	-	-	
RF AGC Delay Setting Range		$V_{IN\ DELAY}$		(Note 14)		5	7	9	V
AFT Band Width		ΔF_W	2	(Note 13)		1.4	-	-	MHz
Video Output Voltage		v_{OUT}	2	(Note 15)		2.25	2.5	2.75	V
SIF Output Voltage		S_{OUT}	3	(Note 16)		200	400	600	mV_{rms}

SIF SECTION

CHARACTERISTIC		SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Input Limitting Voltage		$v_{IN(LIM)}$	8	(Note 17) $R_D=\infty$	-	200	400	μV_{rms}
AM Rejection Ratio		AMR	8	SIF IN : f=4.5MHz f_m=400Hz, $\Delta f=\pm25$kHz AM 30%, v_{in}=100dBμ	40	45	-	dB
Recovered Output Voltage		V_{OD}	8	SIF IN : f=4.5MHz f_m=400Hz, $\Delta f=\pm25$kHz v_{in}=80dBμ, R_D=12kΩ	0.5	0.75	-	V_{rms}
Total Harmonic Distortion		THD_{DET}	8	SIF IN : f=4.5MHz f_m=400Hz, $\Delta f=\pm25$kHz v_{in}=80dBμ	-	1.0	-	%
Max. Audio Output Voltage		v_{OM}	8	SIF IN : f=4.4~4.6MHz	4.0	-	-	V_{p-p}
SIF Input Impedance		$R_{IN(SIF)}$	7	f=4.5MHz	10.0	20.0	30.0	kΩ
		$C_{IN(SIF)}$			-	3.0	-	pF
DET Output Impedance		$R_{o(DET)}$	9	(Note 18)	10.0	15.0	20.0	kΩ
DC Voltage	Terminal 21	V_{21}	1	SW_1:1 (TA7680AP)	3.5	4.4	5.3	V
	Terminal 23	V_{23}		2 (TA7681AP)	4.8	6.0	7.2	V
	Terminal 1	V_1		SW_2:2	6.0	6.7	7.4	V
Max. Attenuation		ATT MAX	10	(Note 19)	60	-	-	dB
DC Volume Gain		$G_{ATT\ MIN}$	10	R_A=0 $G_{ATT\ MIN}=20\log\frac{v_2}{v_{23}}$	4	6	8	dB
ATT Characteristics	1	$V_{1(1)}$	10	※	3.4	3.8	4.2	V
	2	$V_{1(2)}$	10	※※	4.5	4.9	5.3	V
Signal Leakage		v_{PT}	11	(Note 20)	-	1.0	3.0	mV_{rms}
AF Amp. Gain		G_V AF	13	(Note 21)	-	20	-	dB
AF Amp. Distortion		THD AF	12	$P_{23A}=1V_{pp}$, 400Hz SW_3:ON ATT:-26dB Setting	-	1.5	-	%
AF Amp. Max. Output Voltage		$v_{OAF\ MAX}$	13	(Note 21) THD_{AF} 5%	1.5	2.0	-	V_{rms}
AF Output DC Voltage		V_3	1	SW_1:1 (TA7680AP) 2 (TA7681AP) SW_2:2	6.7	7.7	8.8	V

※ Read the 400Hz component of V_{A1} at P_2 with R_A=0. Set R_A so that $V_{A1}'=\frac{1}{2}V_{A1}$ (-6dB), then read DC voltage of terminal 1 (V_1).

※※ Read the 400Hz component of V_{A1} at P_2 with R_A=0. Set R_A so that $V_{A1}'=3.16\times10^{-3}\ V_{A1}$ (-50dB) then read DC voltage of terminal 1 (V_1).

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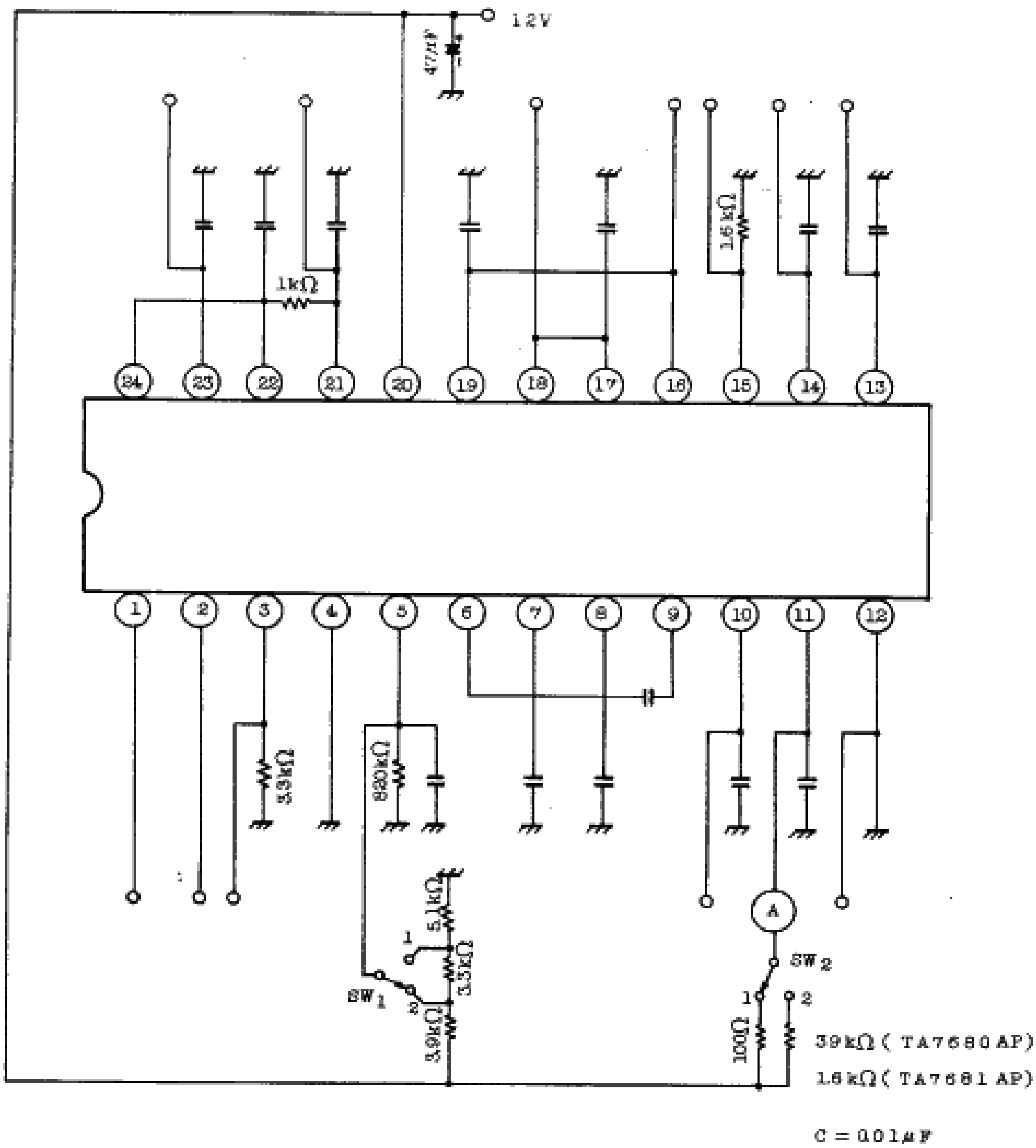
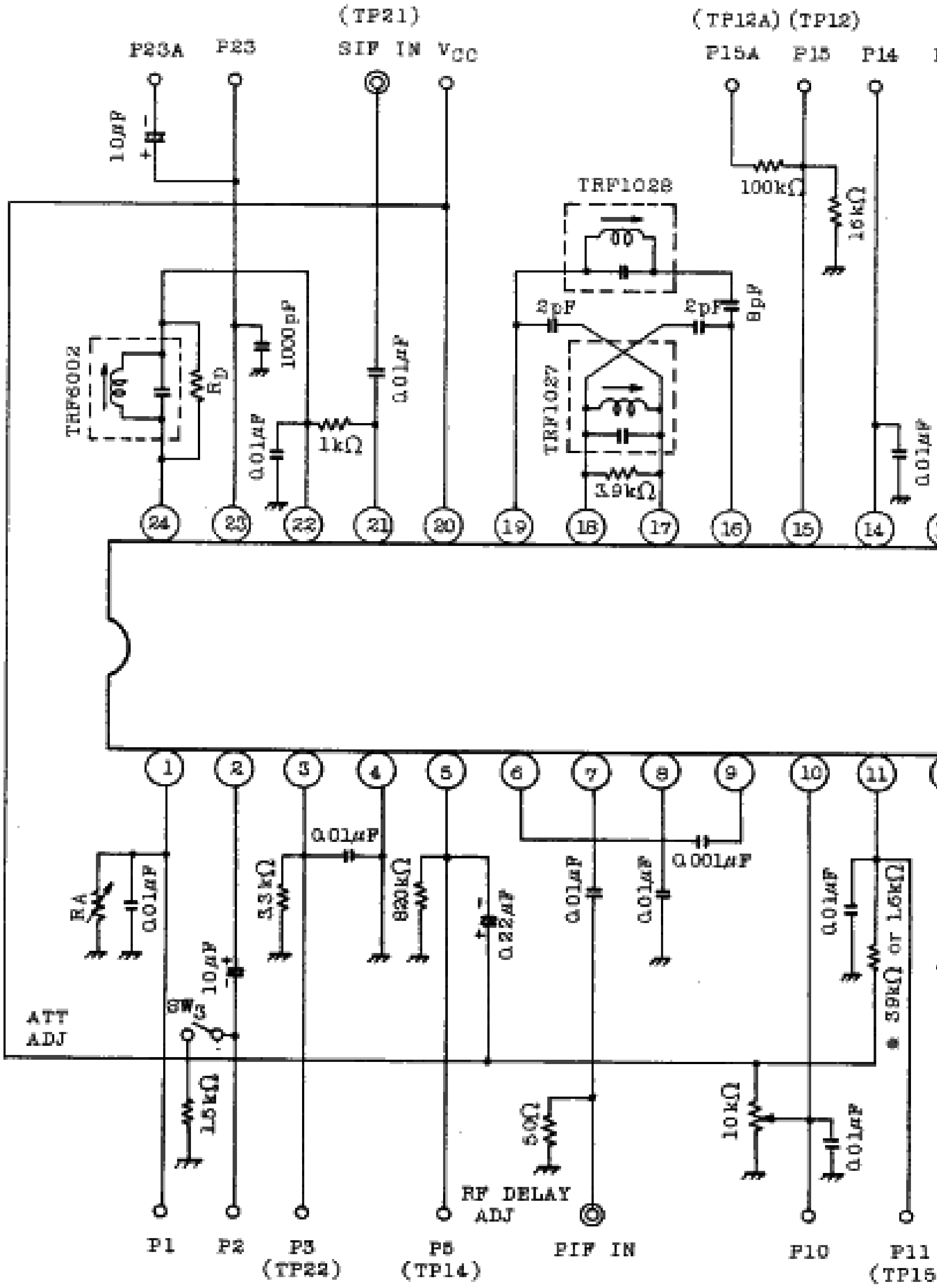
TEST CIRCUIT

1. DC CHARACTERISTIC



2. AC CHARACTERISTIC



* 3.9kΩ : TA7680AP

* 1.6kΩ : TA7681AP

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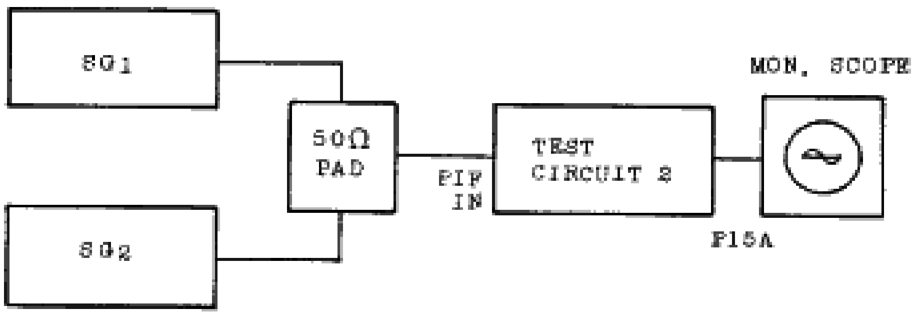
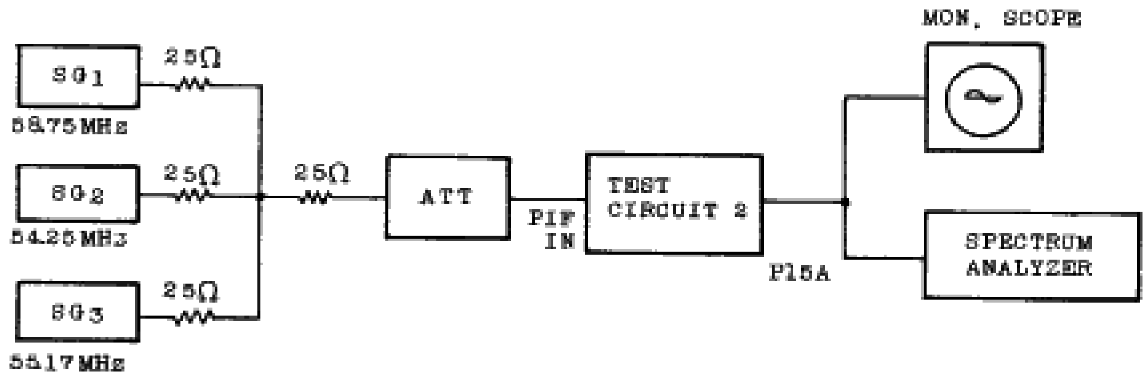
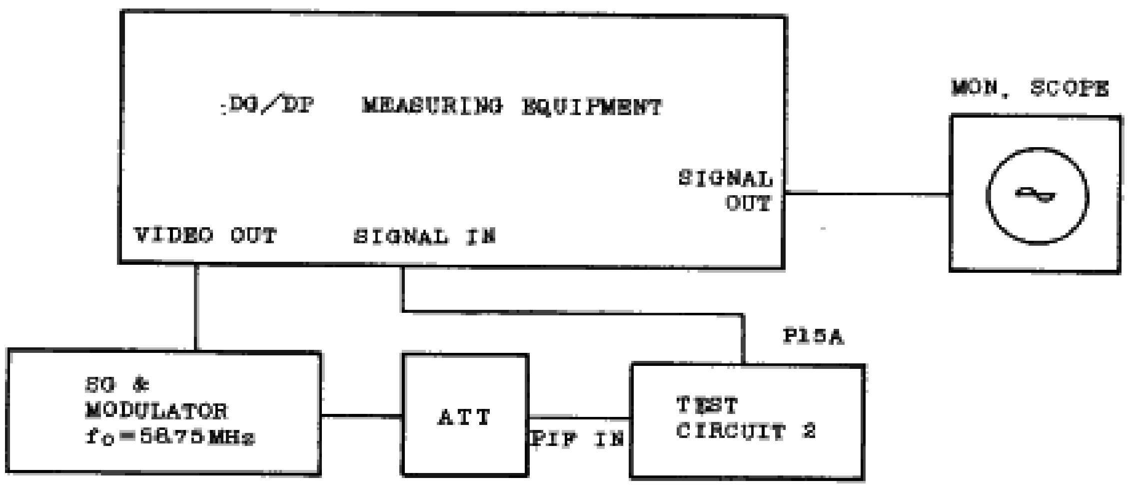
3. VIDEO FREQUENCY RESPONSE AND SIF OUTPUT VOLTAGE



4. INTER MODULATION



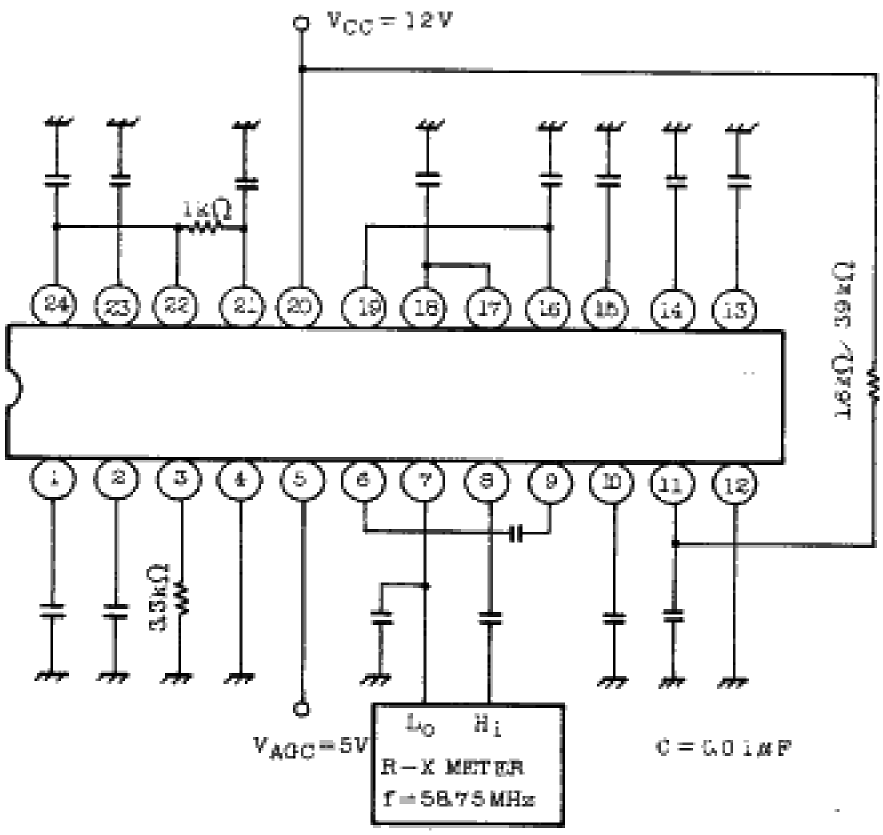
5. DG, DP



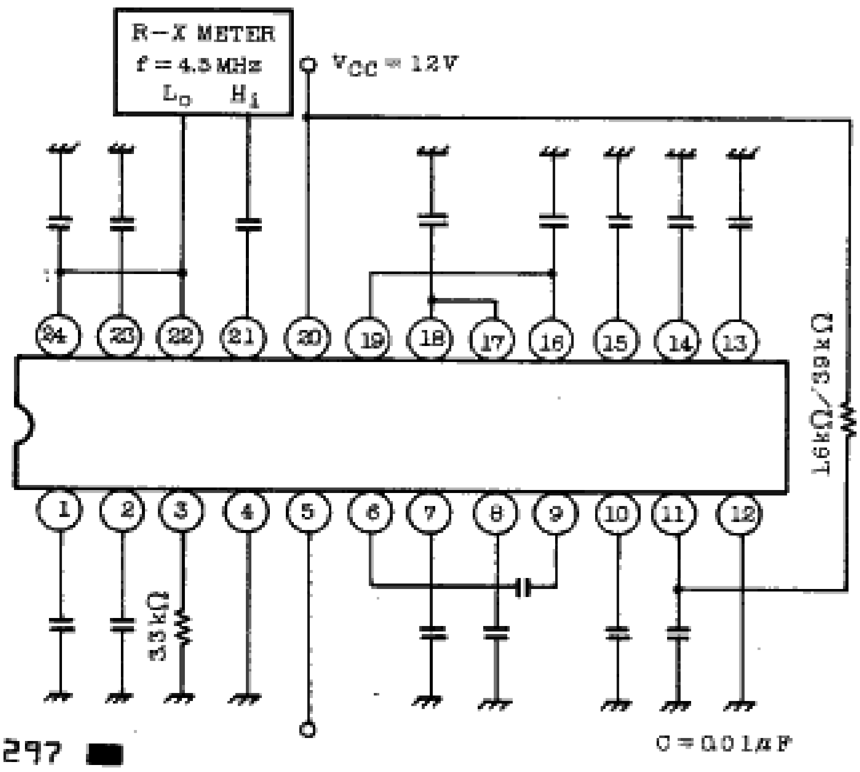
APL=50%

ATT : ADJUST SYNC TIP LEVEL TO DC 2.5V

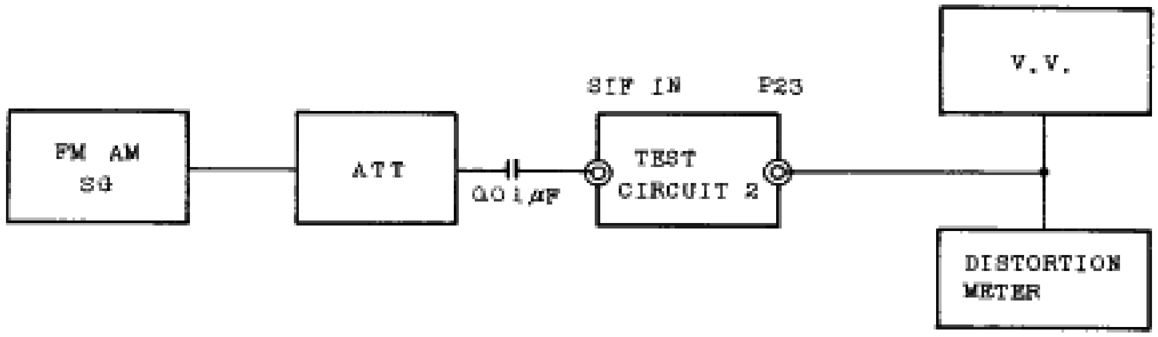
6. PIF INPUT IMPEDANCE



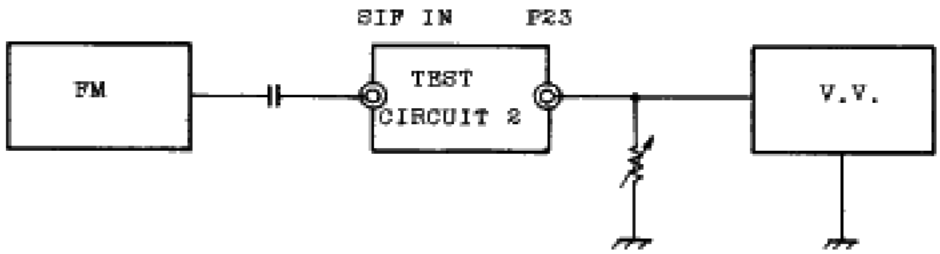
7. SIF INPUT IMPEDANCE



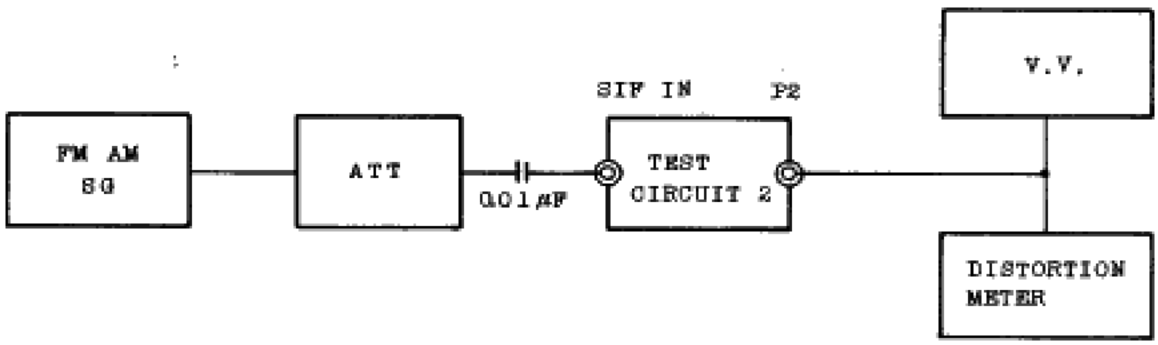
8. $v_{IN(LIM)}$, AMR, V_{OD}, THD, v_{OM}



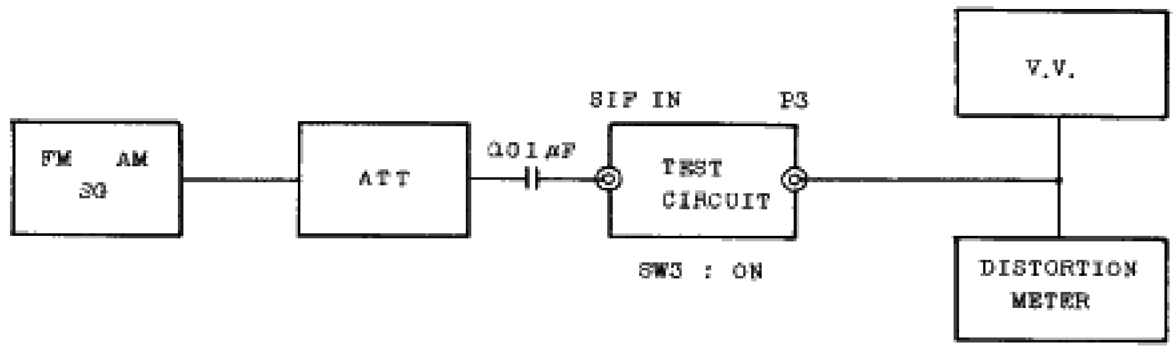
9. AUDIO OUTPUT IMPEDANCE



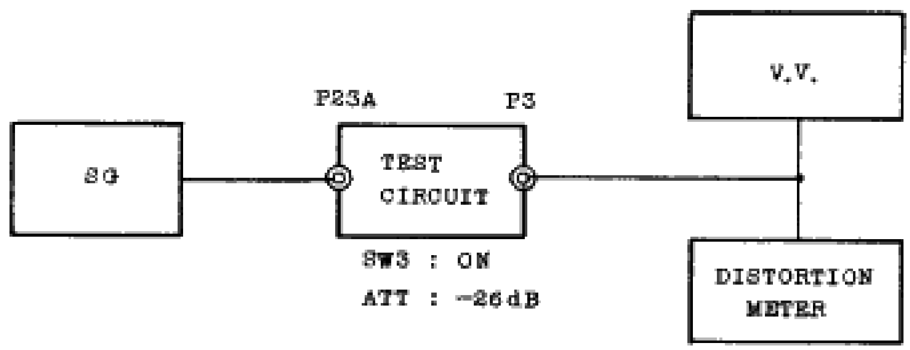
10. ATT MAX., $G_{ATT\ MIN}$, $V_{1(1)}$, $V_{1(2)}$



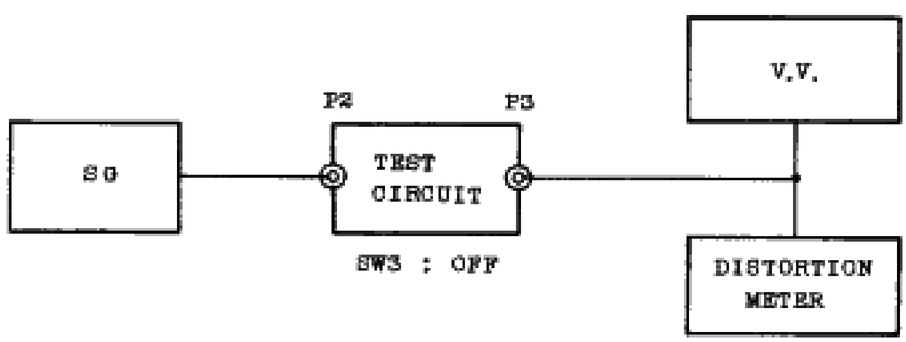
11. v_{PT}



12. THD_{AF}



13. $G_{V\ AF}$, $v_{OAF\ MAX}$:



TEST CONDITION

Note 1) V_{AGC} (P5 EXT. Applying Voltage)=11.5V
PIF IN ; f=58.75MHz 1kHz 30% AM Modulation.
Adjust PIF Input Level v_i so that the detected output of P15A with high impedance probe will be $0.8V_{p-p}$ and measure the Input Level.

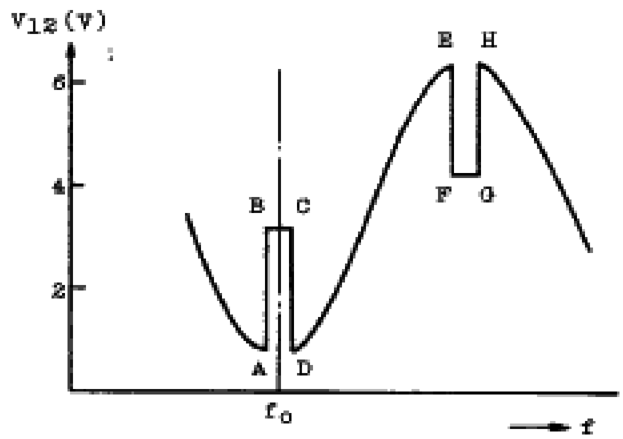
Note 2) V_{AGC}=4V
Measure PIF Input Level v_i' same as NOTE 1

$$\Delta A = 20\log\frac{v_i'}{v_i} \text{ [dB]}$$

Note 3) PIF IN ; f=58.75MHz CW $15mV_{rms}$
Measure DC level of P15

Note 4) PIF IN ; f=58.75MHz APL 100%, 87.5% AM modulation.
P5 : open
(1) Adjust PIF Input Level $50mV_{p-p}$ and measure the detected output level v_{01p-p}
(2) Then increase the Input Level so that the detected output level will be $1.1\times v_{01p-p}$ and measure the Input Level.

Note 5) V_{AGC}=8V
PIF IN ; f=58.75MHz±10MHz variable or sweep $15mV_{rms}$ measure DC level of P15.



AD	V_{BTH}
BC	V_{BCL}
EH	V_{WTH}
FG	V_{WCL}

Note 6) V_{AGC}=8V (GR ≈ 30dB)

SG_1 : 58.75MHz CW

SG_2 : 58.65 ~ 40MHz Variable

(1) Setting output of SG_1 so that DC level of P15 will be 4.0V

(2) Setting output of SG_2 (58.65MHz) so that AC level of P15 will be $0.5V_{p-p}$

(3) Decreasing frequency of SG_2 until AC level of P15 will be $0.35V_{p-p}$ (-3dB of $0.5V_{p-p}$) then read f_{SG2}=F

f_{BW}=58.75-F MHz

Note 7) SG_1 ; 58.75MHz, 1kHz 80% AM modulation $100mV_{rms}$

SG_2, SG_3 ; OFF

Setting V_{AGC} so that output AC level of P15 will be $2.7V_{p-p}$

Measure CL of P15 after setting to 0% AM of SG_1

$$CL = 20 \log \frac{2.7}{v_{CR}(V_{p-p})} \quad (dB)$$

Note 8) Measure I_{2nd} of P15 same as NOTE 7

Note 9) V_{AGC}=8V

SG_1 ; 58.75MHz (P; Picture) $100mV_{rms}$

SG_2 ; 54.25MHz (S; Sound) $32mV_{rms}$(-10dB of SG_1)

SG_3 ; 55.17MHz (C; Chroma) $32mV_{rms}$(-10dB of SG_1)

(1) Setting V_{AGC} so that the output tip level (lower) of P15 will be 3.0V DC

(2) Measure the level difference (dB) between c-level and 920kHz level

Note 10) V_{AGC}=8V

PIF IN ; f=58.75MHz Video Signal (ramp) 87.5% AM $100mV_{p-p}$

Setting ATT so that the sync tip level of P15 will be 2.5V DC

Measure DP and DG.

Note 11) V_{AGC}=5V f=58.75MHz

Measure R_{IN}, C_{IN}

Note 12) AFT Sensitivity $\Delta F/\Delta(V_{13}-V_{14})$

(1) INT, AGC (P5 Open)

(2) PIF Input ; 58.75MHz ±1.0MHz, CW $15mV_{rms}$

(3) Read the frequency (f_1) of PIF when $V_{13}-V_{14}=-1V$

(4) Read the frequency (f_2) of PIF when $V_{13}-V_{14}=1V$

Then caluculate

$\Delta F/\Delta(V_{13}-V_{14})=|f_1-f_2|$

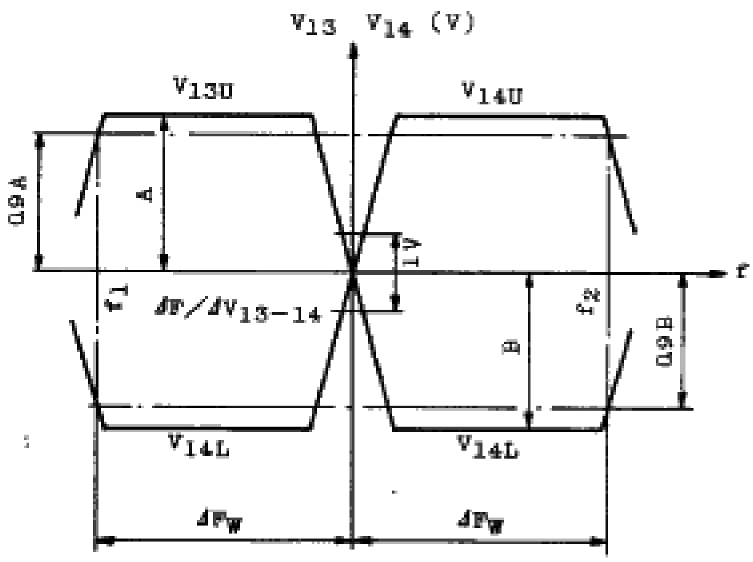
Note 13) ΔF_W, V_{13U}, V_{14U}, V_{13L}, V_{14L}

(1) INT AGC (P5 Open)

(2) PIF IN ; 58.75MHz ±10MHz CW $15mV_{rms}$

(3) 8pF at Pin 16 should be shorted

(4) Read the frequency (f_1 or f_2) when the V_5 or V_6 reduced to 90% level of A or B with varying the frequency. Then band width is the difference from center frequency (f_0).



Note 14) P5 : Open

PIF IN ; 58.75MHz CW $20mV_{rms}$

(1) Adjust the voltage of terminal 3 so that the voltage of terminal 4 will be 6.0V DC

(2) Measure the terminal voltage 3

Note 15) P5 : Open

PIF IN ; 58.75MHz 100% APL 87.5% AM modulation signal amplitude $50mV_{p-p}$

Measure detected output voltage (White peak to sync Tip)

Note 16) P5 : Open

SG_1 ; 58.75MHz CW $100mV_{rms}$

SG_2 ; 54.25MHz CW $25mV_{rms}$

Measure SIF (4.5MHz) output voltage at P15

Note 17) SIF IN ; f=4.5MHz FM f_{MOD}=400Hz $\Delta f=\pm 25kHz$

(1) Adjust SIF Input Level $100mV_{p-p}$ and measure the detected output level v_{OS}

(2) Then decrease the Input Level so that the detected output level will be 3dB down of v_{OS} and measure the Input Level

Note 18) Output Impedance

(1) SIF IN ; f=4.5MHz, f_{MOD}=400Hz, $\Delta f=\pm 25kHz$, 80dBμ

(2) AT P23 read the V01 at $R_X=\infty$, then read the R_X when recovered output become $V_{0I}/2$ with varying the R_X.

The R_X is the output impedance.

Note 19) ATT MAX.

(1) SIF IN ; f=4.5MHz, f_{MOD}=400Hz, $\Delta f=\pm 25kHz$, 80dBμ

(2) Read the 400Hz component of V_{A1} at P2 with $R_A=0$, then read V_{A1}' with $R_A=\infty$.

$$\text{ATT MAX} = 20 \log \frac{V_{A1}}{V_{A1}'}$$

Note 20) v_{PT}

(1) SIF IN ; f=4.5MHz, f_{MOD}=400Hz, $\Delta f=\pm 25kHz$, 80dBμ

(2) Read the 400Hz component at P3

Note 21) G_V AF

(1) Apply 400Hz $0.1V_{rms}$ signal to P2

(2) Read the output voltage at P3

APPLICATION CIRCUIT