Ordering number : EN5764

Monolithic Linear IC

LA7566

VIF/SIF IF Signal-Processing Circuit with TV/VCR PAL and NTSC Multisound Support

Overview

The LA7566 is a VIF/SIF IC that supports PAL and NTSC multisound and that adopts a semi-adjustment-free system. To simplify adjustment, the VIF block adopts a technique in which AFT adjustment is no longer required by VCO adjustment. The SIF block supports audio multi-detection by adopting a PLL detection technique. The SIF block provides 4 inputs with IC internal switching for easy design of multi-sound systems. Additionally, these switches can also be used for video system sound trap switching. The LA7566 also includes a buzz canceller that suppresses Nyquist buzz to achieve improved audio quality.

Functions

[VIF Block]
- VIF amplifier • PLL detector • BNC • RF AGC
- EQ amplifier • AFT • IF AGC • Buzz canceller

[First SIF Block]
- First SIF amplifier • First SIF detector • AGC

[SIF Block]
- Multiple input switch • Limiter amplifier • PLL FM detector

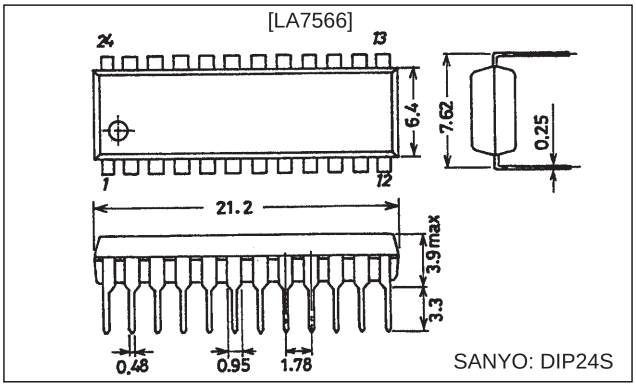
Features

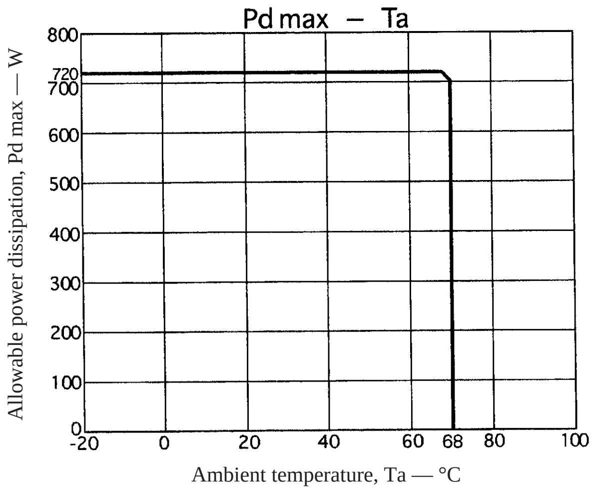
- No coils are used in the AFT and SIF blocks, making these circuits adjustment free.
- PAL / NTSC multisound system can be constructed easily.
- Built-in buzz canceller for excellent audio performance

Package Dimensions

unit: mm

3067-DIP24S





Specifications

Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_{CC} max		10	V
Circuit voltage	V7, V9, V10, V17		V_{CC}	V
Circuit current	I1		–2	mA
	I13		–3	mA
	I18		–10	mA
Allowable power dissipation	Pd max		720	mW
Operating temperature	Topr		–20 to +70	°C
Storage temperature	Tstg		–55 to +150	°C

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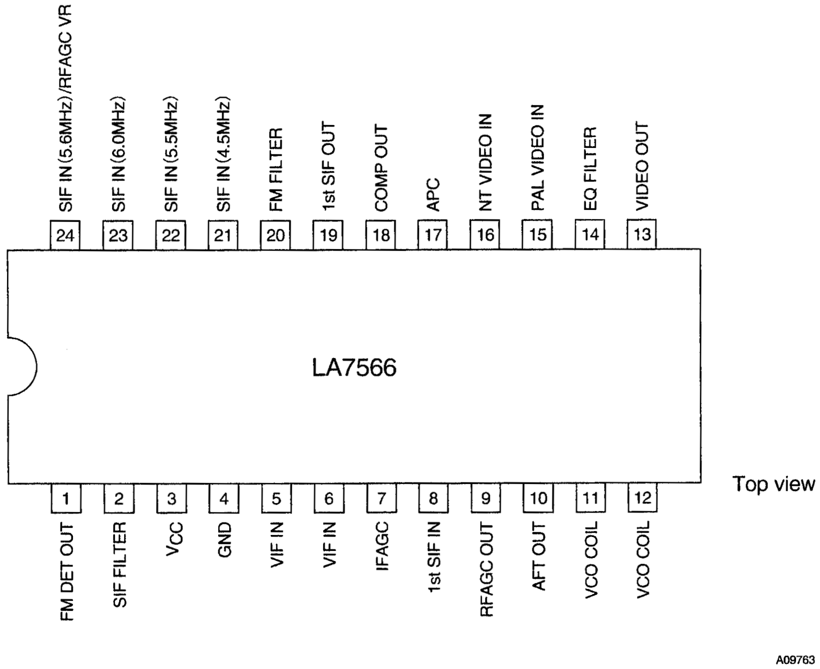
Operating Conditions at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	V_{CC}		9	V
Operating supply voltage range	V_{CC} op		4.6 to 9.5	V

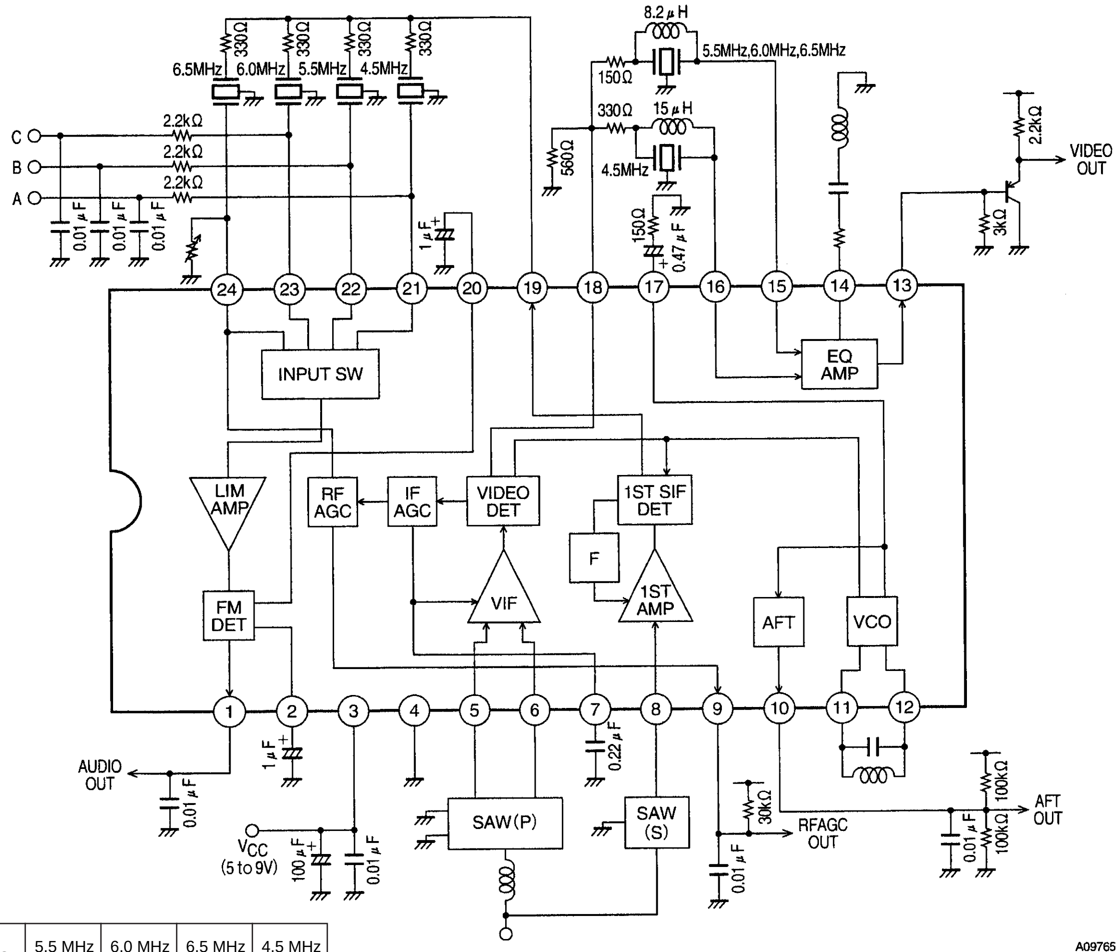
Operating Characteristics at Ta = 25°C, V_{CC} = 9 V, fp = 38.9 MHz

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
[VIF Block]						
Circuit current	I3		45	53	61	mA
Maximum RF AGC voltage	V9H		7.5	8.1		V
Minimum RF AGC voltage	V9L			0	0.5	V
Input sensitivity	V_{IN}	S1 = OFF	28	34	40	dBµV
AGC range	G_R		45	50		dB
Maximum allowable input	V_{IN} max		95	100		dBµV
No-signal video output voltage	V13		3.7	4.0	4.3	V
Sync tip voltage	V13 tip		1.3	1.6	1.9	V
Video output level	V_O		1.7	2.0	2.3	Vp-p
Black noise threshold voltage	V_{BTH}		0.7	1.0	1.3	V
Black noise clamp voltage	V_{BCL}		2.0	2.3	2.6	V
Video signal-to-noise ratio	S/N		48	52		dB
C-S beat	IC-S		44	49		dB
Frequency characteristics	f_C	6 MHz	–3	–1.5		dB
Differential gain	DG			3	8	%
Differential phase	DP			3	8	deg
Maximum AFT voltage	V10H		7.5	8.5	9.0	V
Minimum AFT voltage	V10L		0	0.2	1.0	V
AFT detection sensitivity	Sf		29	37	47	mV/kHz
VIF input resistance	Ri	38.9 MHz		1.5		kΩ
VIF input capacitance	Ci	38.9 MHz		3		pF
APC pull-in range (U)	f_{PU}		1.0	1.5		MHz
APC pull-in range (L)	f_{PL}			–1.5	–0.8	MHz
AFT tolerance frequency 1	dfa1		–500	0	+500	kHz
VCO 1 maximum variability range (U)	dfu		1.7	2.0		MHz
VCO 1 maximum variability range (L)	dfl			–2	–1	MHz
VCO control sensitivity	B		1.15	2.3	4.6	kHz/mV
[First SIF Block]						
Conversion gain	VG		32	35	38	dB
5.5 MHz output level	S_O		84	87	90	mVrms
Maximum first SIF input	S_{IN} max		85	88	91	mVrms
First SIF input resistance	R_{IN}(SIF)	33.4 MHz		2		kΩ
First SIF input capacitance	C_{IN}(SIF)	33.4 MHz		3		pF
[SIF Block]						
Limiting sensitivity	VIi(lim)			43	49	dBµV
FM detector output voltage	V_O(FM)	5.5 MHz ± 30 kHz	390	500	630	mVrms
AM rejection ratio	AMR		50	60		dB
Total harmonic distortion	THD			0.2	1.5	%
SIF S/N	S/N (FM)		55	60		dB
[SIF Switch Block] Switches A, B, and C: H = open, L = ground						
NTSC mode 6-dB amplifier	NTSW		5	6	7	dB
SIF crosstalk 21	CT21		51	57		dB
SIF crosstalk 22	CT22		51	57		dB
SIF crosstalk 23	CT23		51	57		dB
SIF crosstalk 24	CT24		51	57		dB
Switch threshold low-level voltage	SW (L)		1.0	1.5		V

Pin Assignment



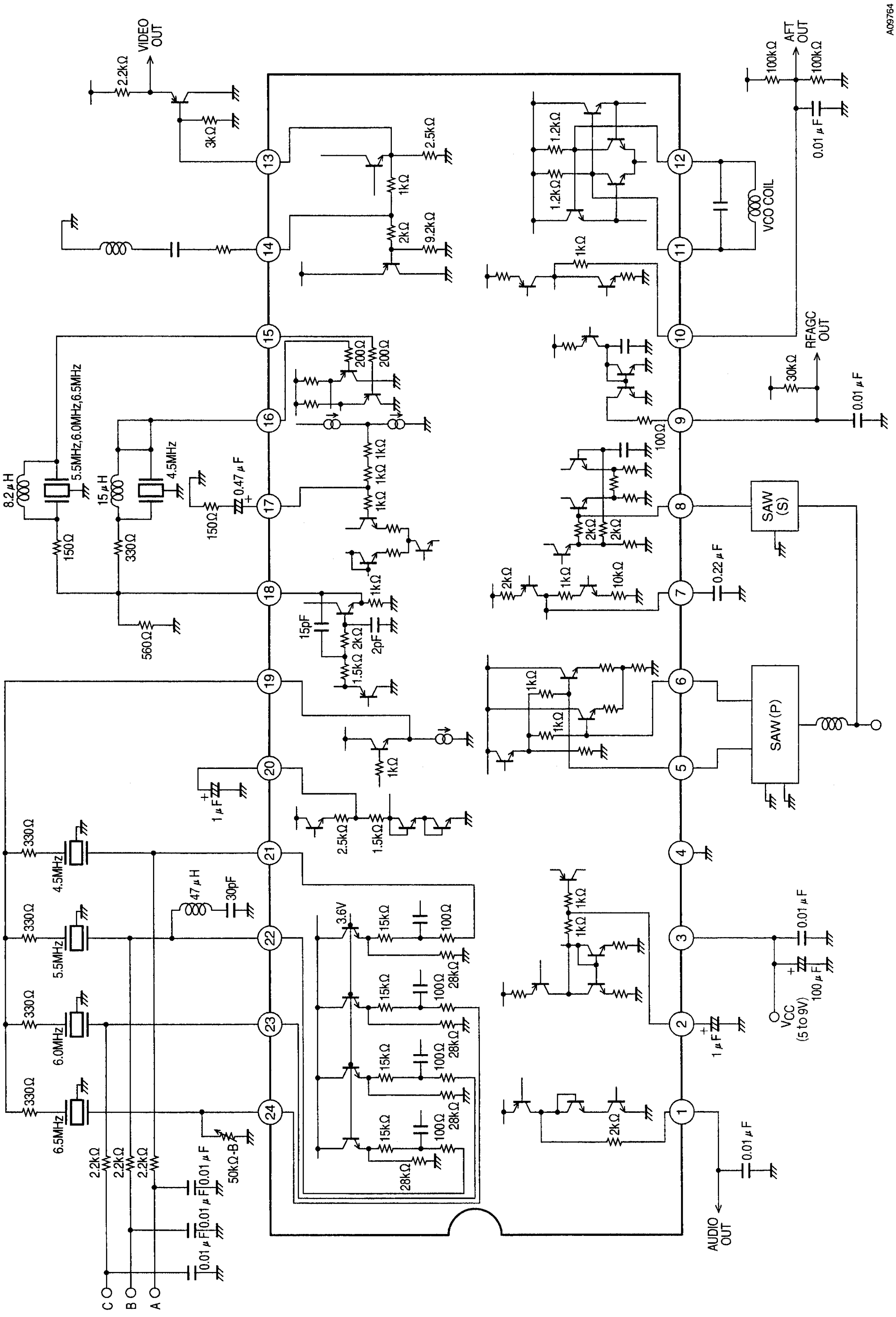
Application Circuit Diagram



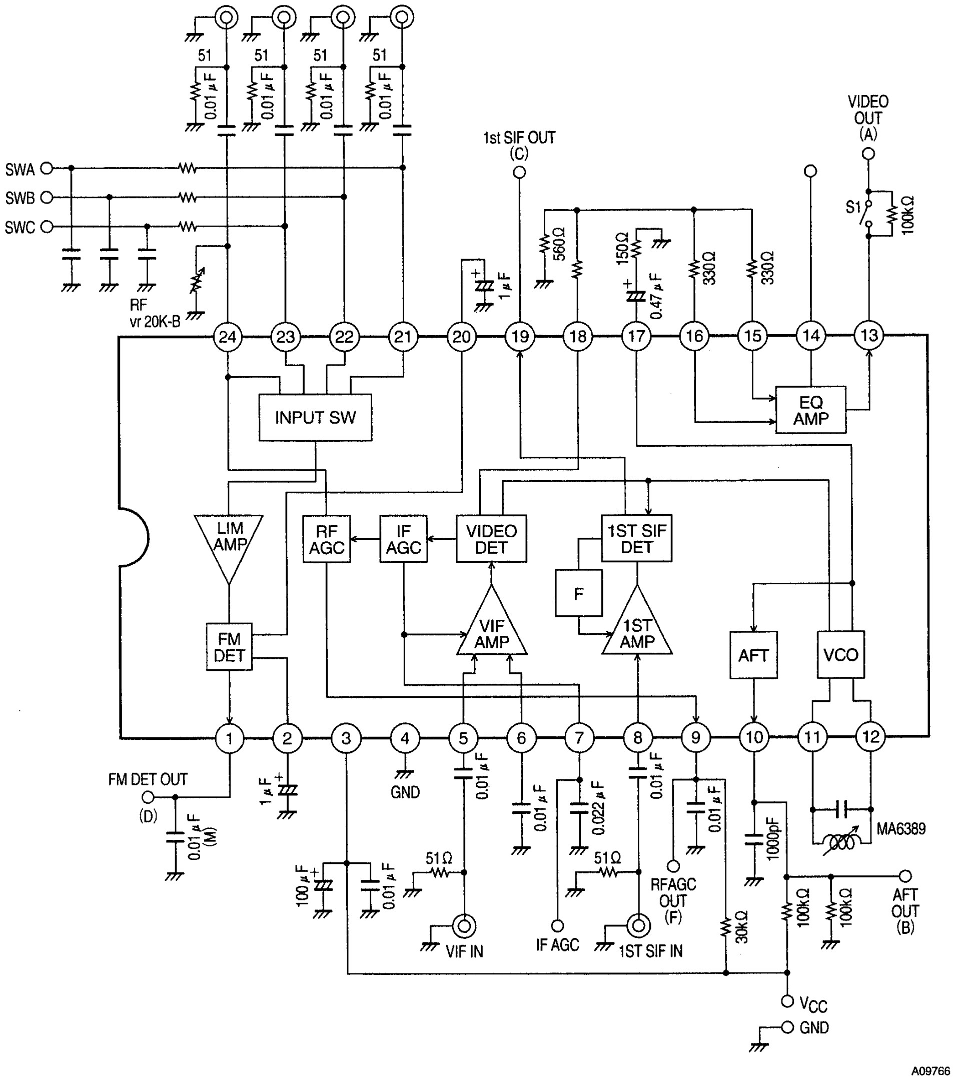
Switch A	Switch B	Switch C	5.5 MHz	6.0 MHz	6.5 MHz	4.5 MHz
H	H	H	○			
H	H	L		○		
H	L	H			○	
H	L	L				○
L	H	H	○	○	○	
L	L	L	○	○	○	○
L	H	L		○	○	
L	L	H		○	○	

H : OPEN
L : GND

Internal Equivalent Circuit Diagram

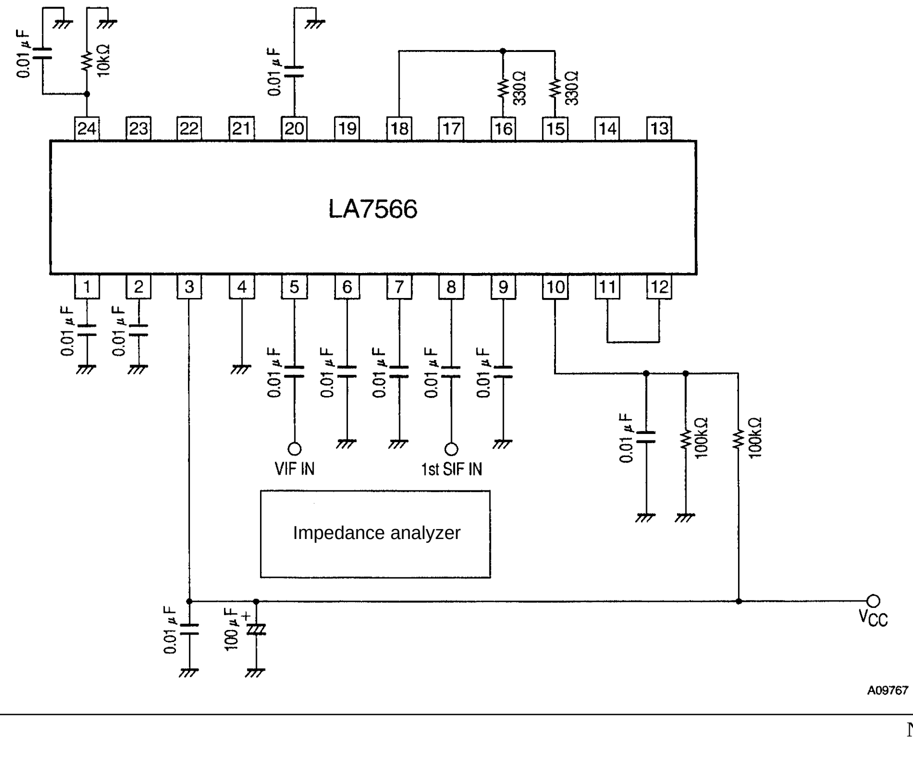


AC Characteristics Test Circuit Diagram

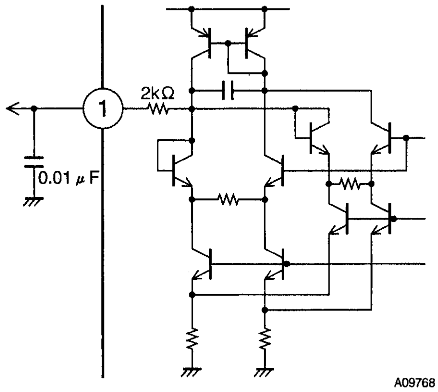
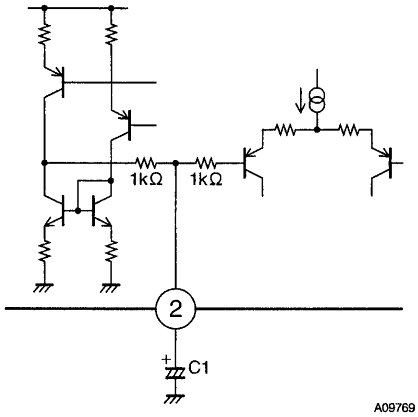
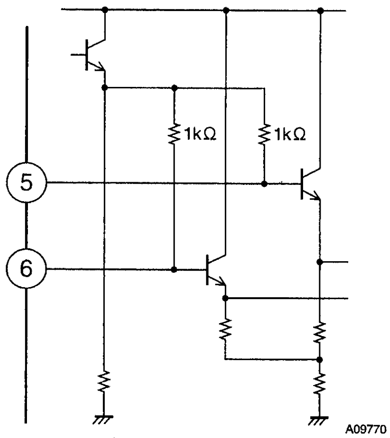


Test Circuit

Input Impedance Test Circuit (VIF and first SIF input impedance)



Pin Functions

Pin No.	Symbol	Pin function	Equivalent circuit
1	FM DET OUT	• Audio FM detector output. Deemphasis is switched internally in the IC. (5 kΩ and 7.5 kΩ) This switching is linked to the SIF input switch. An external emitter-follower circuit must be provided if the deemphasis is disabled.	
2	SIF FILTER	• Connection for a filter that holds the FM detector output DC voltage at a fixed level. Normally, a 1-µF electrolytic capacitor is used. To improve the low band (around 50 Hz) frequency characteristics, increase the value of this capacitor (C1).	
5 6	VIF IN	• VIF amplifier input. The input circuit is constructed as a balanced input, and the input has the following impedance characteristics: R ≈ 1.5 kΩ C ≈ 3 pF	

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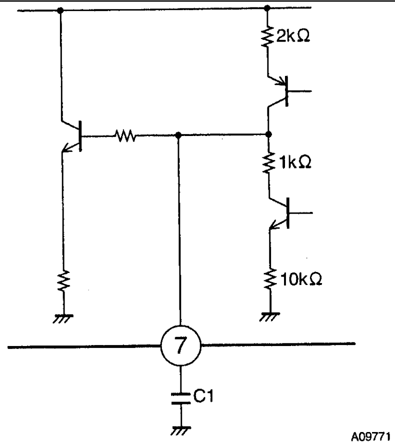
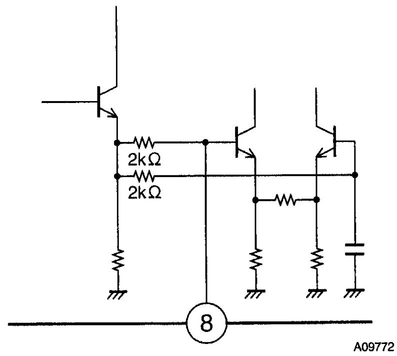
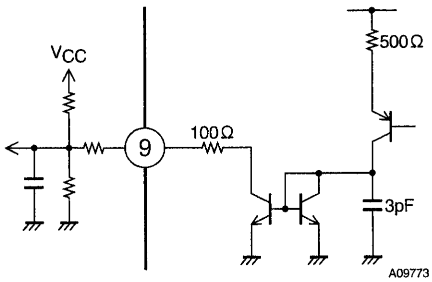
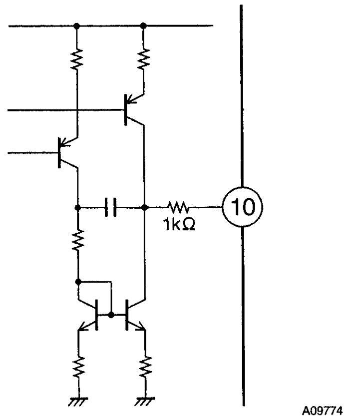
Pin No.	Symbol	Pin function	Equivalent circuit
7	IF AGC	• IF AGC filter connection. The AGC voltage is created at pin 7 from the signal to which peak detection was applied by the internal AGC detector. Additionally, the IC includes an internal second AGC filter (a lag-lead filter) used to create a dual time constant. A 0.022 µF capacitor is used as the external capacitor. The value of this capacitor must be adjusted according to measurement of the sag, AGC speed, and other circuit aspects.	
8	1st SIF IN	• First SIF input. A DC cut capacitor must be inserted in the input to this circuit. When a SAW filter is used: The first SIF sensitivity can be increased by inserting an inductor between the SAW and the IC to match the SAW output and IC input capacitances. When an intercarrier system is used: This pin must be connected to ground through a capacitor.	
9	RF AGC OUT	• RF AGC output. This output controls the tuner RF AGC. This is an open-collector output with an inserted 100-Ω protective resistor. Determine the value of the external bleeder resistor to match the tuner specifications.	
10	AFT OUT	• AFT output. The AFT center voltage is created with an external bleeder resistor. The AFT gain increases as the value of this bleeder resistor increases. The value of this resistor must not exceed 390 kΩ. This circuit includes a control function that controls the AFT voltage to be equal to the center voltage in weak field reception conditions.	

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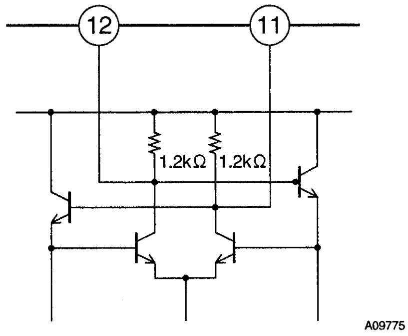
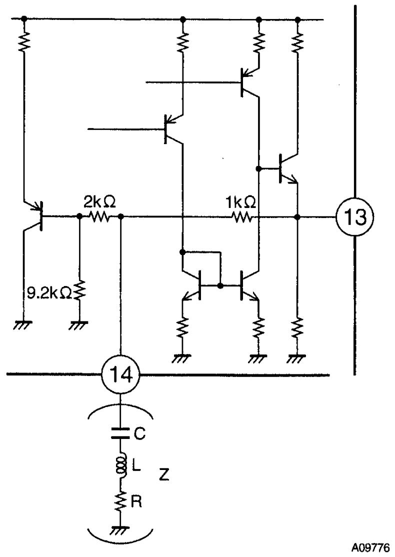
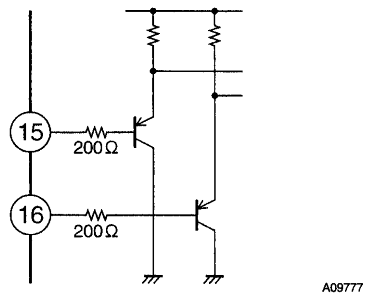
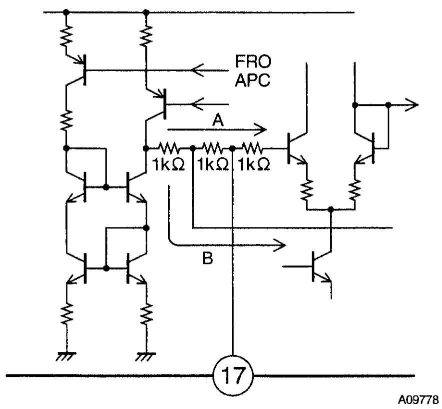
Pin No.	Symbol	Pin function	Equivalent circuit
11 12	VCO	• VCO tank circuit used for video detection. See the separately provided documentation for the tank circuit coil (inductor) specifications.	
13 14	VIDEO OUT EQ FILTER	• Equalizer circuit. This circuit corrects the video signal frequency characteristics. • Notes on equalizer amplifier design: The equalizer amplifier is designed as a voltage follower amplifier with a gain of about 2.3 dB. When the frequency characteristics are corrected, connect an inductor, a capacitor, and a resistor in series between pin 14 and ground. The equalizer amplifier gain is given by: $AV = \frac{R1}{Z} + 1$ Here, R1 is an IC internal resistor with a value of 1 kΩ. Select Z according to the desired characteristics. However, care is required to prevent distortion at the resonant point determined by Z, where the gain is maximum.	
15 16	PAL VIDEO IN NT VIDEO IN	• Equalizer amplifier inputs. Pin 15 is for PAL, and pin 16 for NTSC format signals. These inputs are linked to and switched by the SIF switches.	
17	APC FILTER	• PLL detector APC filter connection. The APC time constants are switched internally in the IC. When locked, the VCO is controlled over the path A, and the loop gain is reduced. When unlocked and during weak field reception, the VCO is controlled over the path B, thus increasing the loop gain. We recommend values of: R = 150 to 390 Ω, and C = 0.47 μF for the loop filter constants.	

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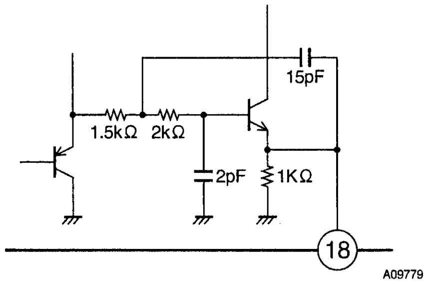
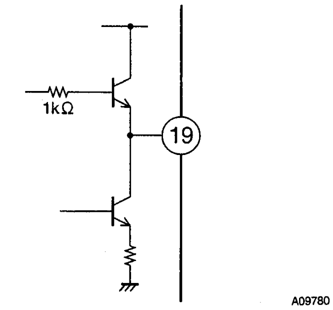
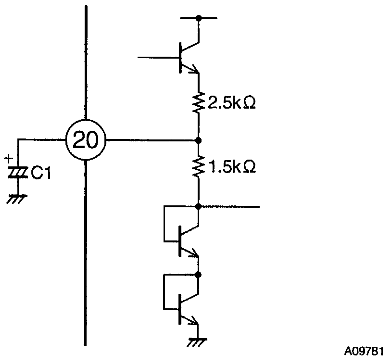
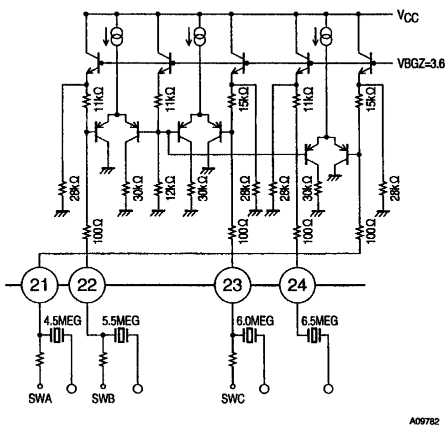
Pin No.	Symbol	Pin function	Equivalent circuit
18	COMP OUT	• Output for the video signal that includes the SIF carrier. A resistor must be inserted between pin 18 and ground to acquire an adequate drive capability. R ≥ 470 Ω	
19	1st SIF OUT	• First SIF output The signal output from this pin is passed through a bandpass filter and input to the SIF circuit. This is an emitter-follower output.	
20	FM FILTER	• The FM detector signal-to-noise ratio can be improved by inserting a filter in the FM detector bias line. C1 should have a value of 0.47 µF or greater, and 1 µF is recommended . If the FM detector is not used, pin 20 must be connected to ground through a 2-kΩ resistor. This stops the FM detector VCO circuit.	
21 22 23 24	SIF IN (4.5 MHz) SIF IN (5.5 MHz) SIF IN (6.0 MHz) SIF IN (6.5 MHz) RF AGC VR	• SIF inputs. Four input pins are provided to support multi-side systems, and a switching function is also included. Since buzzing and bass beating can occur if interference signals, such as the video signal or the chrominance signal, enter these pins, extra care must be taken in designing the input circuit pattern layout. Note that pin 24 also functions as the RF AGC adjustment pin. This pin sets the tuner RF AGC operating point. Also, the FM output and the video output can be muted at the same time by setting this pin to the ground level.	

Switch A	Switch B	Switch C	5.5 MHz	6.0 MHz	6.5 MHz	4.5 MHz
H	H	H	○			
H	H	L		○		
H	L	H			○	
H	L	L				○
L	H	H	○	○	○	
L	L	L	○	○	○	○
L	H	L		○	○	
L	L	H		○	○	

Notes on Sanyo SAW Filters

There are two types of SAW filters, which differ in the piezoelectric substrate material, as follows:

1. Lithium tantalate (LiTaO3) SAW filter
   TSF11 □ □ □ …… Japan
   TSF12 □ □ □ …… US

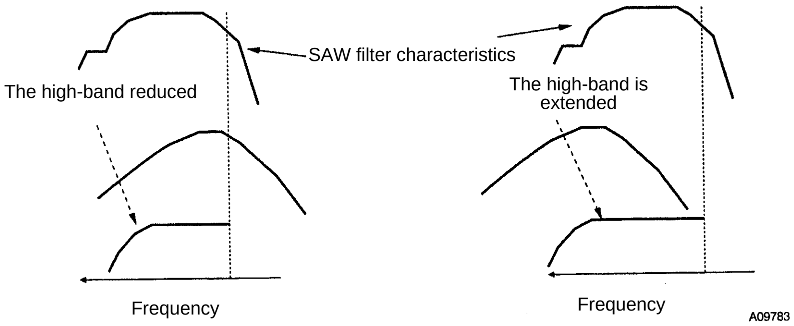
Although lithium tantalate SAW filters have the low temperature coefficient of –18 ppm/°C, they suffer from a large insertion loss. However, it is possible, at the cost of increasing the number of external components required, to minimize this insertion loss by using a matching circuit consisting of coils and other components at the SAW filter output. At the same time as minimizing insertion loss, this technique also allows the frequency characteristics, level, and other aspects to be varied, and thus provides increased circuit design flexibility. Also, since the SAW filter reflected wave level is minimal, the circuit can be designed with a small in-band ripple level.

2. Lithium niobate (LiNbO3) SAW filter
   TSF52 □ □ □ …… US
   TSF53 □ □ □ …… PAL

Although lithium niobate SAW filters have the high temperature coefficient of –72 ppm/°C, they feature an insertion loss about 10 dB lower than that of lithium tantalate SAW filters. Accordingly, there is no need for a matching circuit at the SAW filter output. Although the in-band ripple is somewhat larger than with lithium tantalate SAW filters, since they have a low impedance and a small field slew, they are relatively immune to influences from peripheral circuit components and the geometry of the printed circuit board pattern. This allows stable out-of-band trap characteristics to be acquired. Due to the above considerations, lithium tantalate SAW filters are used in applications for the US and Japan that have a high IF frequency, and lithium niobate SAW filters are used in PAL and US applications that have a low IF frequency.

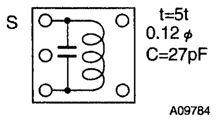
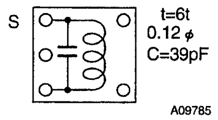
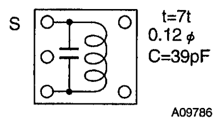
Notes on SAW Filter Matching

In SAW filter input circuit matching, rather than matching the IF frequency, flatter video band characteristics can be acquired by designing the tuning point to be in the vicinity of the audio carrier rather than near the chrominance carrier. The situation shown in figure on the right makes it easier to acquire flat band characteristics than that in figure on the left.



With the tuning set to the IF frequency   With the tuning set to the vicinity of S and C

Coil Specifications

	JAPAN f = 58.75 MHz	US f = 45.75 MHz	PAL f = 38.9 MHz
VCO coils	 Test production No. 16991A Tokyo Parts Industrial Co., Ltd.	 Test production No. 16687A Tokyo Parts Industrial Co., Ltd.	 Test production No. 16686A Tokyo Parts Industrial Co., Ltd.
SAW filters (split)	Picture TSF1137U SOUND	Picture TSF1241 SOUND	Picture TSF5315 SOUND
SAW filters (inter)		TSF5220 TSF5221	TSF5321 TSF5344

Tokyo Parts Industrial Co., Ltd. 236 Hinode Machi Isesaki Shi, Gunma Prefecture Japan TEL: +81-270-23-3731

Notes on VCO Tank Circuits

1. Built-in capacitor VCO tank circuits
   When the power is turned on, the heat generated by the IC is transmitted through the printed circuit board to the VCO tank circuit. At this point, the VCO coil frame functions as a heat sink and the IC heat is dissipated. As a result, it becomes more difficult to transmit heat to the VCO tank cricuit's built-in capacitor, and the influence of drift at power on is reduced. Therefore, it suffices to design the circuit so that the coil and capacitor thermal characteristics cancel. Ideally, it is better to use a coil with a core material that has low temperature coefficient characteristics.

2. External capacitor VCO tank circuits
   When an external capacitor is used, heat generated by the IC is transmitted through the printed circuit board directly to the VCO tank circuit external capacitor. While this capacitor is heated relatively early after the power is turned on, the coil is not influenced as much by this heat, and as a result the power-on drift is increased. Accordingly, a coil whose core material has low temperature coefficient characteristics must be used. It is also desirable to use a capacitor with similarly low temperature coefficient characteristics.

   Note: Applications that use an external capacitor here must use a chip capacitor. If an ordinary capacitor is used, problems such as the oscillator frequency changing with the capacitor orientation may occur.