Ordering number : ENN*6930

Monolithic Linear IC

LA75505M

Adjustment Free VIF/SIF Signal Processing IC for TV/VCR

Preliminary

Overview

The LA75505M is a VIF/SIF signal processing IC for NTSC TV/VCR. It supports the 45.75 MHz and 58.75 MHz as the IF frequencies. On-chip sound carrier trap and sound carrier BPF circuits make it ideal for compact and light-weight tuner applications. To adjust the VCO circuit, AFT circuit, and sound filter, 4-MHz external crystal or 4-MHz external signal is needed.

Functions

- VIF amplifier
- VCO adjustment free PLL detection circuit
- Digital AFT circuit
- RF AGC
- Buzz canceller
- Equalizer amplifier
- Internal sound carrier BPF
- Internal sound carrier trap
- PLL-FM detector
- Reference oscillation circuit

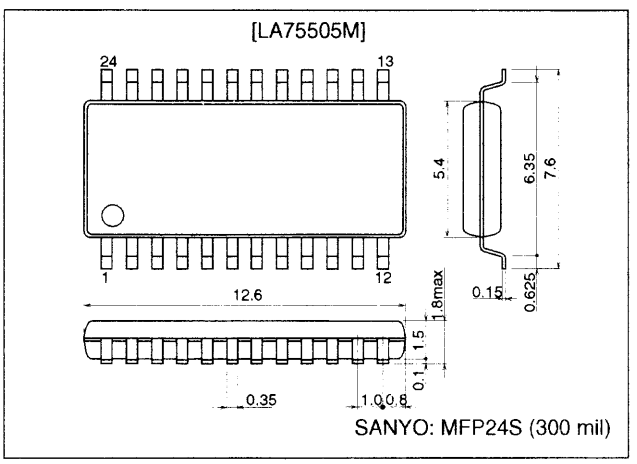
Features

- Internal VCO adjustment free circuit eliminating need for VCO coil adjustments.
- Considerably reduces the number of required peripheral parts by providing on-chip sound carrier BPF and sound carrier trap circuits.
- Use of digital AFT eliminates problem of AFT tolerance.
- Package: MFP24S (300 mil)

Package Dimensions

unit: mm

3112-MFP24S



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Specifications

Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_{CC} max		7	V
Allowable power dissipation	Pd max	Ta ≤ 70°C (*Mounted on a printed circuit board)	470	mW
Operating temperature	Topr		−20 to +70	°C
Storage temperature	Tstg		−55 to +150	°C

Note: * Circuit board dimensions: 114.3 × 76.1 × 1.6 mm^3, material: glass epoxy

Operating Conditions at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	V_{CC}		5	V
Operating voltage range	V_{CC} op		4.5 to 5.5	V

Electrical Characteristics at Ta = 25°C, V_{CC} = 5.0 V, fp = 45.75 MHz

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
[VIF Block]						
Circuit current	I17			64.0	73.6	mA
Maximum RF AGC voltage	V14H	Collector load 30 kΩ VC2 = 9 V	8.5	9	—	V
Minimum RF AGC voltage	V14L			0.3	0.7	V
Input sensitivity	Vi		33	39	45	dBμV
AGC range	GR		58			dB
Maximum allowable input	Vimax		92	97		dBμV
No-signal video output voltage	V4		3.3	3.6	3.9	V
Synchronizing signal tip voltage	V4tip		1.0	1.3	1.6	V
Video output level	V_O		1.7	2.0	2.3	Vpp
Video signal-to-noise ratio	S/N		46	50		dB
C-S beating	IC-S	P/S = 10 dB	26	32	38	dB
Differential gain	DG	Vin = 80 dBμ		3	10	%
Differential phase	DP			2	10	deg
VIF input resistance	Ri			2.5	3.0	kΩ
VIF input capacitance	Ci			3	6	PF
Maximum AFT voltage	V13H		4.3	4.7	5.0	V
Minimum AFT voltage	V13L		0	0.2	0.7	V
AFT tolerance 1	dfa1	f = 45.75 MHz		±35	±45	kHz
AFT tolerance 2	dfa2	f = 58.75 MHz		±45	±70	kHz
AFT detection sensitivity	Sf	RL = 100 kΩ//100 kΩ	40	80	120	mV/kHz
AFT dead zone	fda			60	100	kHz
APC pull-in range (U)	fpu		1.0	1.5		MHz
APC pull-in range (L)	fpl		1.0	1.5		MHz
VCO maximum frequency range (U)	dfu		1.5	2.0		MHz
VCO maximum frequency range (L)	dfl		1.5	2.0		MHz
VCO control sensitivity	β		2.0	4.0	8.0	kHz/mV
N trap1 (4.75 MHz)	NT1	wrt 1 MHz	−30	−35		dB
N trap2 (5.25 MHz)	NT2	wrt 1 MHz	−19	−24		dB
Group delay 1 NTSC (3.0 MHz)	NGD1	wrt 1 MHz	10	40	70	ns
Group delay 1-1 NTSC (3.5 MHz)	NGD1-1	wrt 1 MHz	70	120	170	ns

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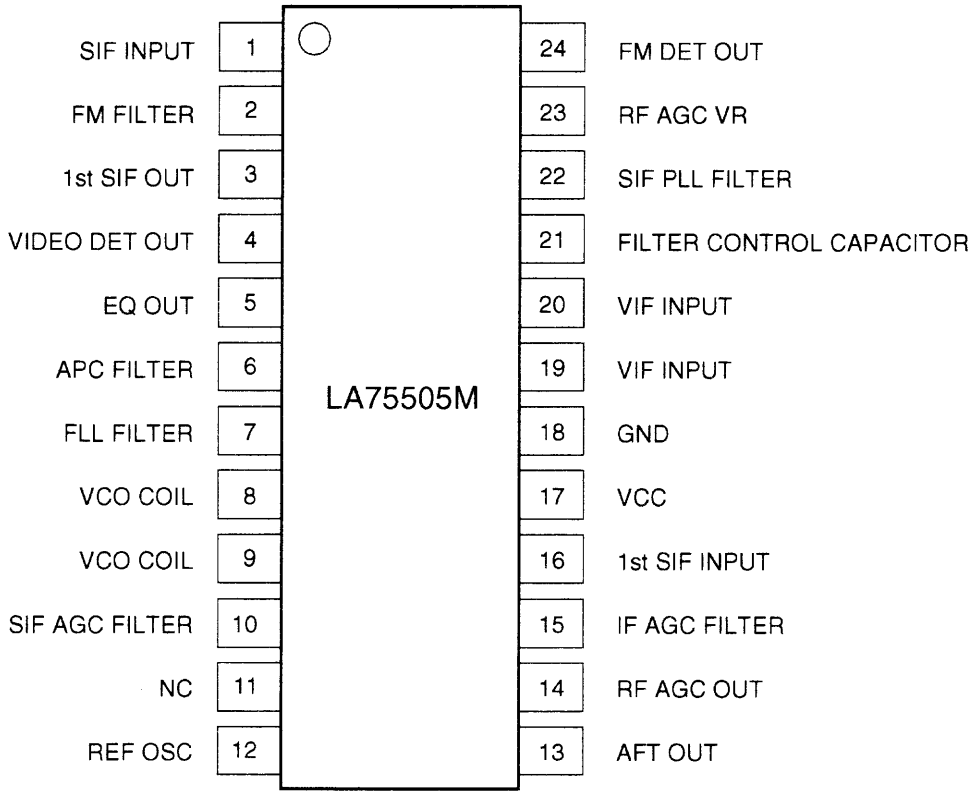
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
[1st SIF Block]						
Conversion gain	Vg	fp = 4.5 MHz, Vi = 500μV	26	32		dB
SIF carrier output level	So	Vi = 10 mV		100		mVrms
First SIF maximum input	Simax	So ±2 dB		106		dBμV
First SIF input resistance	Ris			5.0	6.0	kΩ
First SIF input capacitance	Cis			3	6	pF
[SIF Block]						
Limiting sensitivity	Vi(lim)	fp = 4.5 MHz, ΔF = ±25 kHz at 400 Hz			61	dBμV
FM detector output voltage	Vo(FM)		480	600	750	mVrms
AM rejection ratio	AMR	AM = 30% at 400 Hz	50	60		dB
Total harmonic distortion	THD	f = 4.5 MHz, ΔF = ±25 kHz		0.5	1.0	%
FM detector output S/N	S/N(FM)		55	60		dB
BPF 3-dB bandwidth	BW			±100		kHz
NTSC de-emphasis	Ndeem	fm = 2 kHz		−3		dB
[Others]						
4-MHz level (during external input)	X4MIN	Terminated	86			dBμ
IF system SW threshold resistance	V12				270	kΩ
Split/inter SW	V16			0.5		V

System Switching

- IF system switch
  45.75 MHz is selected as the IF frequency by leaving pin 12 (crystal oscillation) open. 58.75 MHz is selected by adding 220 kΩ between pin 12 and GND.

- Split/inter carrier switch
  Inter carrier is selected by setting the first SIF input (pin 16) to GND.

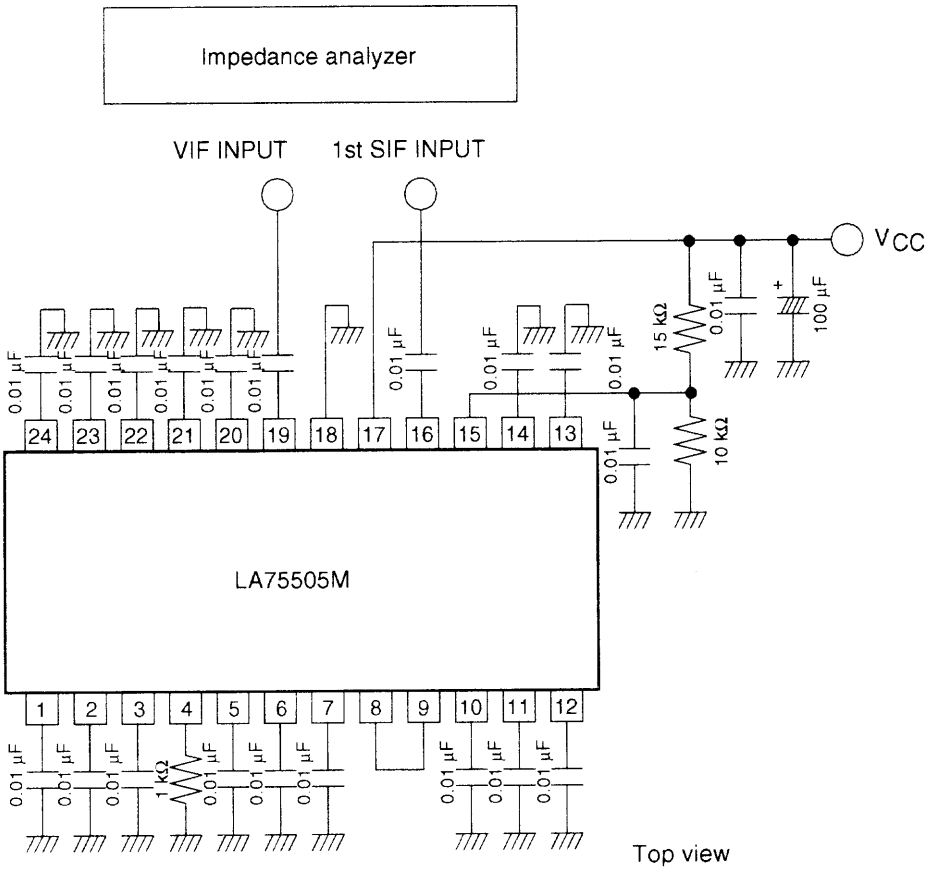
Pin Assignment



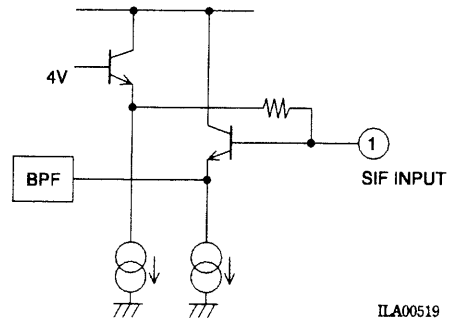
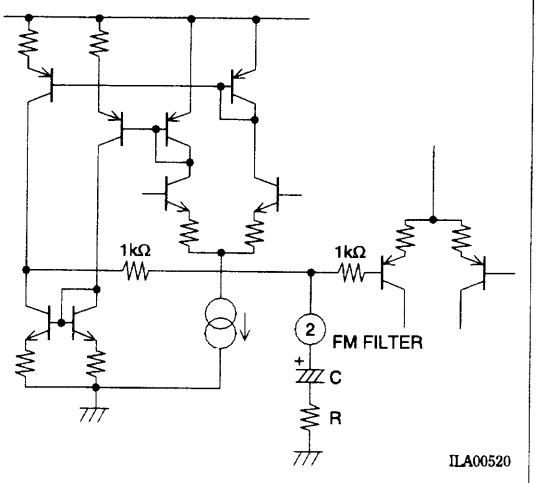
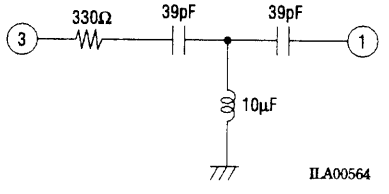
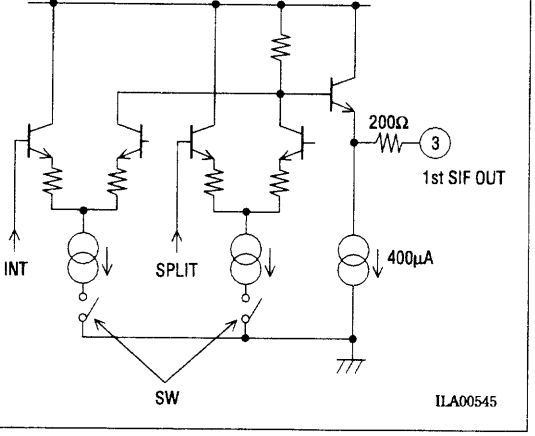
Top view

Test Circuit

Input Impedance Measuring Circuit (VIF, First SIF input impedance)



Pin Functions

Pin No.	Pin	Pin Function	Internal Circuit
1	SIF INPUT	Inputs the SIF signal from the first SIF output. Set the input level to 90 dBμV or lower because of the dynamic range of the internal filter.	
2	FM FILTER	This is the FM feedback filter pin. It is composed of a C and R filters. 1 μF is normally used as the capacitance. If the capacitance is a low value, the audio output level is small at low frequencies. Moreover, the audio output level can be made smaller by increasing the resistance connected in series. Use a resistance of 3 kΩ or higher.	
3	1st SIF OUT	This is the first SIF output. In case of inter carrier, the chroma carrier is bigger than split carrier applications, so that it is recommended to connect a filter externally. Filter example 	

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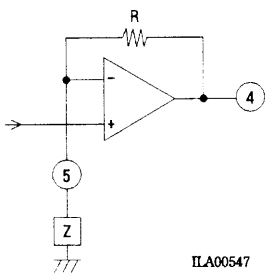
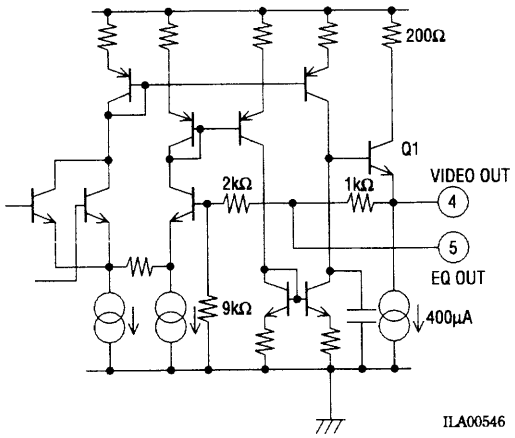
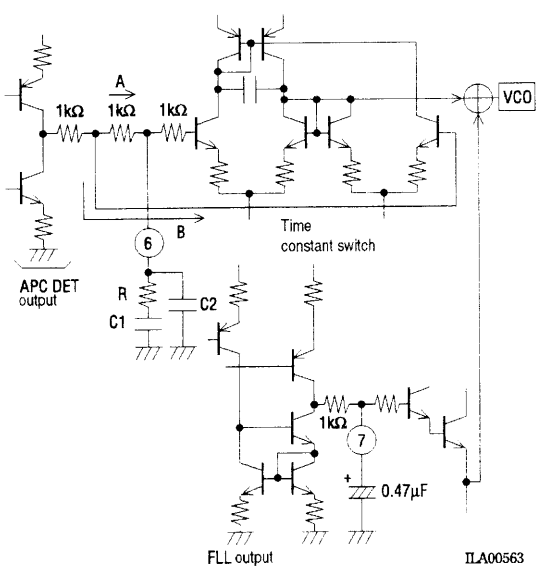
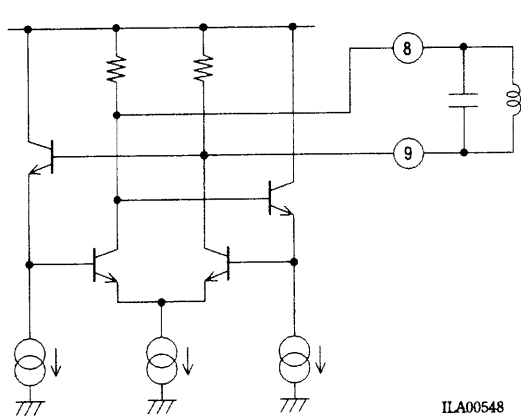
Pin No.	Pin	Pin Function	Internal Circuit
4 5	VIDEO-OUT EQ-OUT	Pin 4 is the video output pin. The EQ amplifier can be thought of as shown below.  ILA00547 Therefore, the peak gain of the EQ amplifier is determined by Av = 1 + R/Z. However, note that the LA75505M being an IC with V_{CC} = 5 V, setting too large an amplitude causes distortion in the V_{CC} side. Use so that the white level is 4 V or less.	 ILA00546
6 7	APC FILTER FLL FILTER	Pin 6 is the PLL detector APC filter pin. Normally the following are used: R = 330 Ω C1 = 0.47 μ to 1 μF C2 = 100 pF C1 = 1 μF is effective for the overmodulation characteristics. When the PLL is locked, the signal passes via the path marked A in the figure, and when PLL is unlocked and in weak signal, the signal passes via the path marked B in the figure. The PLL loop gain can thus be switched in this manner. Pin 7 is a VCO automatic control FLL filter pin. Since it operates always on a small current, using a larger capacitance results in a slower response. Normally, a capacitance between 0.47 μF and 1 μF is used. Moreover, the control range for this pin is between about 3 V to 4.7 V. Since this range is determined when adjusting the VCO tank circuit, set the design center of L and C of VCO so that the voltage of pin 7 is 3.6 V.	 ILA00563
8 9	VCO COIL	This is the VCO tank circuit for the PLL detector. Use a tuning capacitance of 24 pF. For the L and C specifications, use IF45.75 MHz specifications within ±1.5%, and 58.75 MHz specifications within ±1%. Also, design the L and C values so that the voltage of pin 7 is 3.6 V when PLL is locked while using the IF center frequency.	 ILA00548

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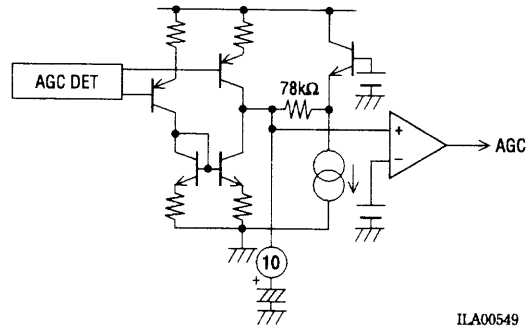
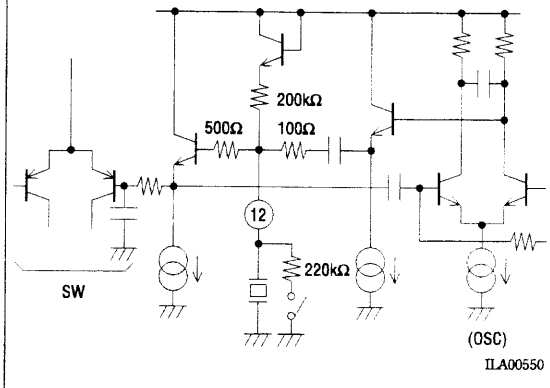
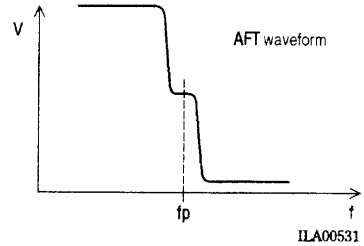
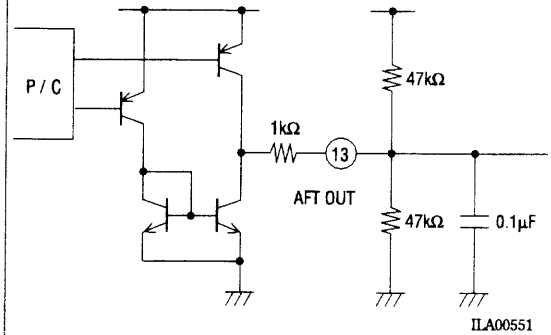
Pin No	Pin	Pin Function	Internal Circuit
10	SIF AGC FILTER	Pin 10 is the SIF AGC filter pin. Use a capacitance of 0.01 µF to 0.1 µF.	
11	NC	Not connected	
12	REF OSC	This pin can be used both as the crystal resonator pin and IF switch. The 58.75-MHz mode is selected by inserting 220 kΩ between pin 12 and GND, the 45.75 MHz mode by leaving the pin open. 4-MHz input is possible from this pin. In the case of 4-MHz external input, input 86 dBµ or more.	
13	AFT OUT	Pin 13 is the AFT output pin. Use external resistors of 47 kΩ and a filter capacitance 0.1 µF. The AFT circuit generates the AFT voltage by comparing the signal obtained by dividing the 4-MHz reference frequency with the signal obtained by dividing VCO. Since it uses a digital phase comparator, a dead zone exists in the AFT center. 	

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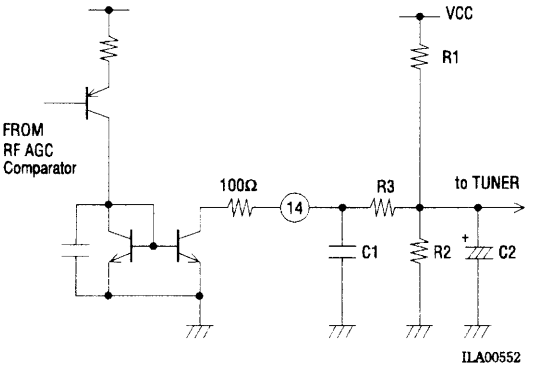
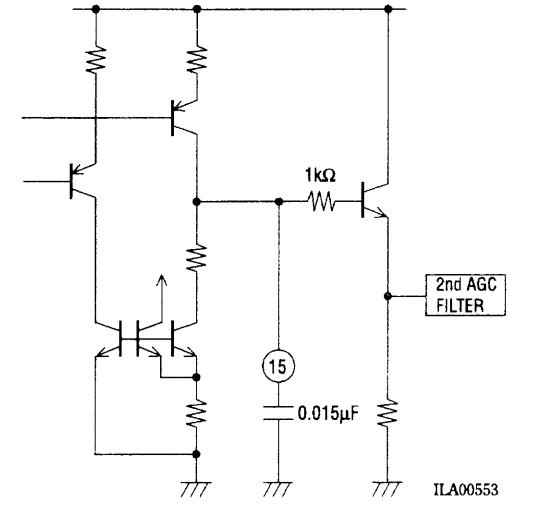
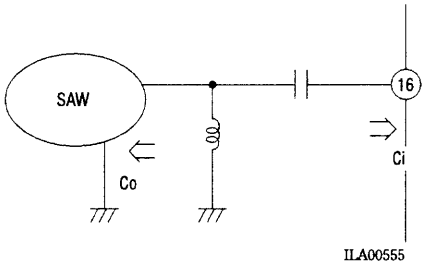
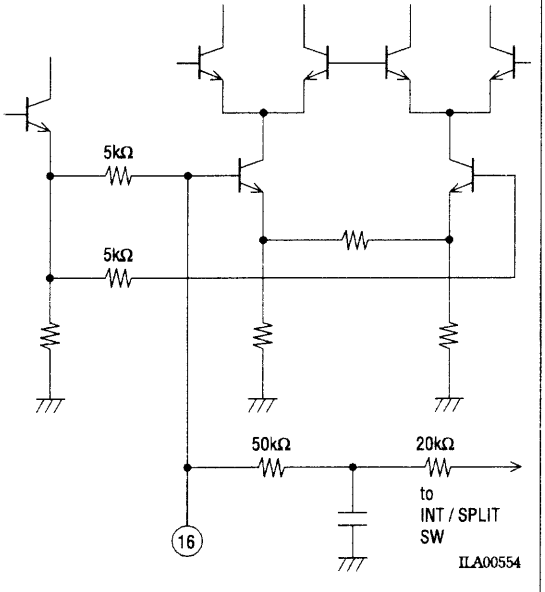
Pin No.	Pin	Pin Function	Internal Circuit
14	RF AGC OUT	Pin 14 is the RF AGC output. RF AGC max is determined by R1 and R2. RF AGC min is determined by R3 and R4. Capacitor C1 prevents oscillation and capacitor C2 is the RF AGC filter. Normally 30 kΩ is used for R1, but if the tuner's F/E transistor is GaAS, the gate's impedance is lower, so use approx. 10 kΩ.	
15	IF AGC FILTER	Pin 15 is the IF AGC filter pin. Normally, 0.01 µF to 0.02 µF polyester film capacitor is used. Determine the impedance based on H-SAG and AGC speed.	
16	1st SIF INPUT	Pin 16 can be used both as the First SIF IN and inter/split switch pins. In the case of inter carrier, connect pin 16 to GND. When a sound saw filter is added, the matching loss can be decreased by inserting L to neutralize the IC input capacitance and saw filter output capacitance. 	

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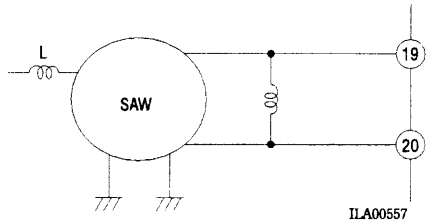
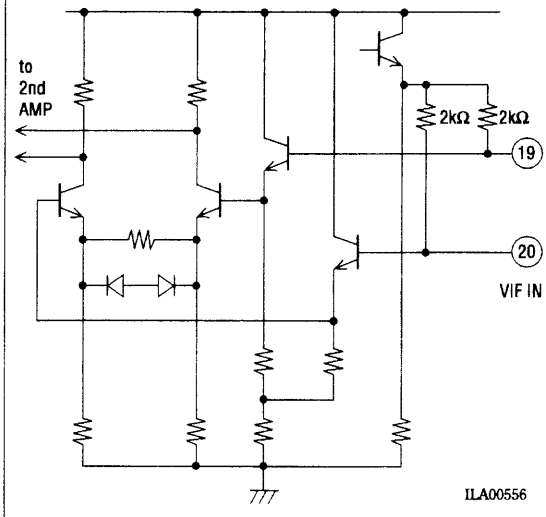
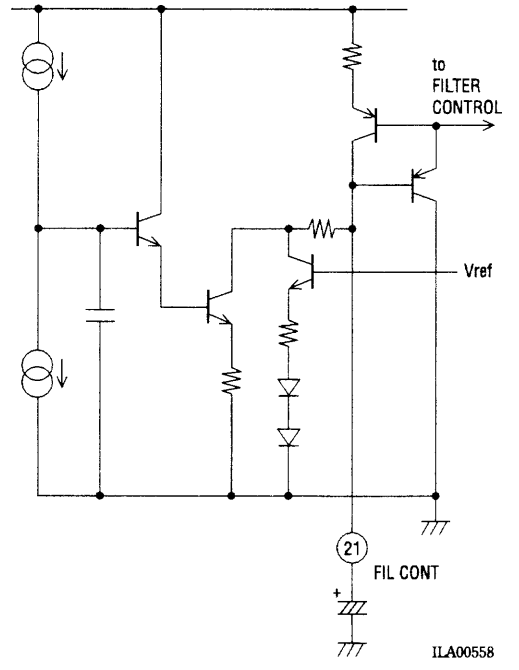
Pin No.	Pin	Pin Function	Internal Circuit
17	V_{CC}	Connect the decoupling capacitor as close as possible.	
18	GND		
19 20	VIF INPUT	Pins 19 and 20 are VIF input pins. To reduce the loss of signal through a saw filter, input registors are set to 2 kΩ. VIF amplifier has three capacitive coupling amplifiers, direct connection from a saw filter is available. 	
21	FILTER CONTROL CAPACITOR	Internal filters (i.e. sound carrier BPF and sound carrier trap) are tuned using the capacitor connected to pin 21. A value between 0.47 µF and 1 µF is considered desirable taking video S/N, and AM and PM noise into consideration.	

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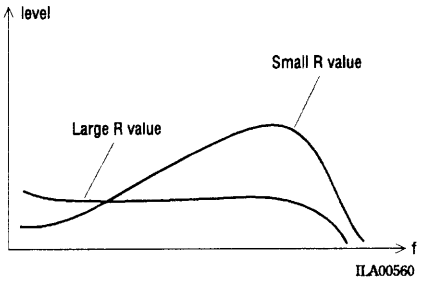
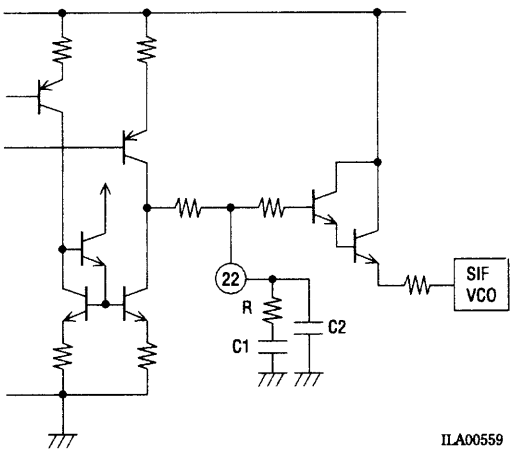
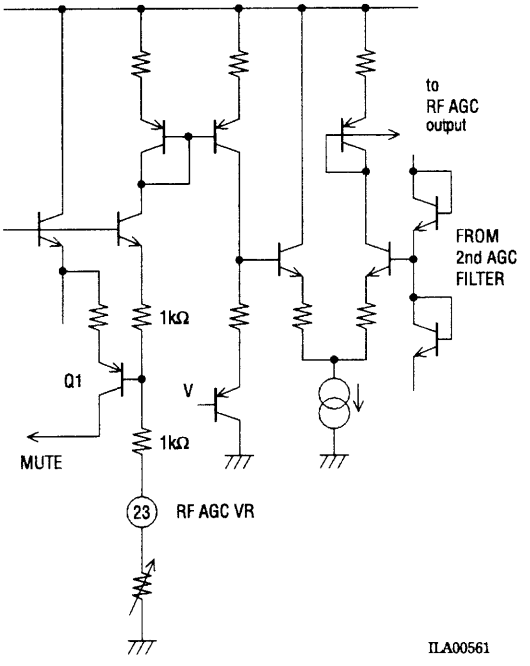
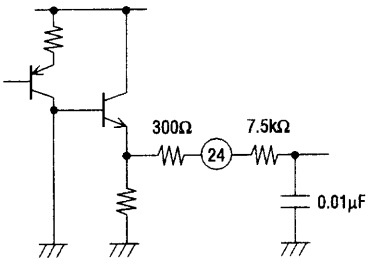
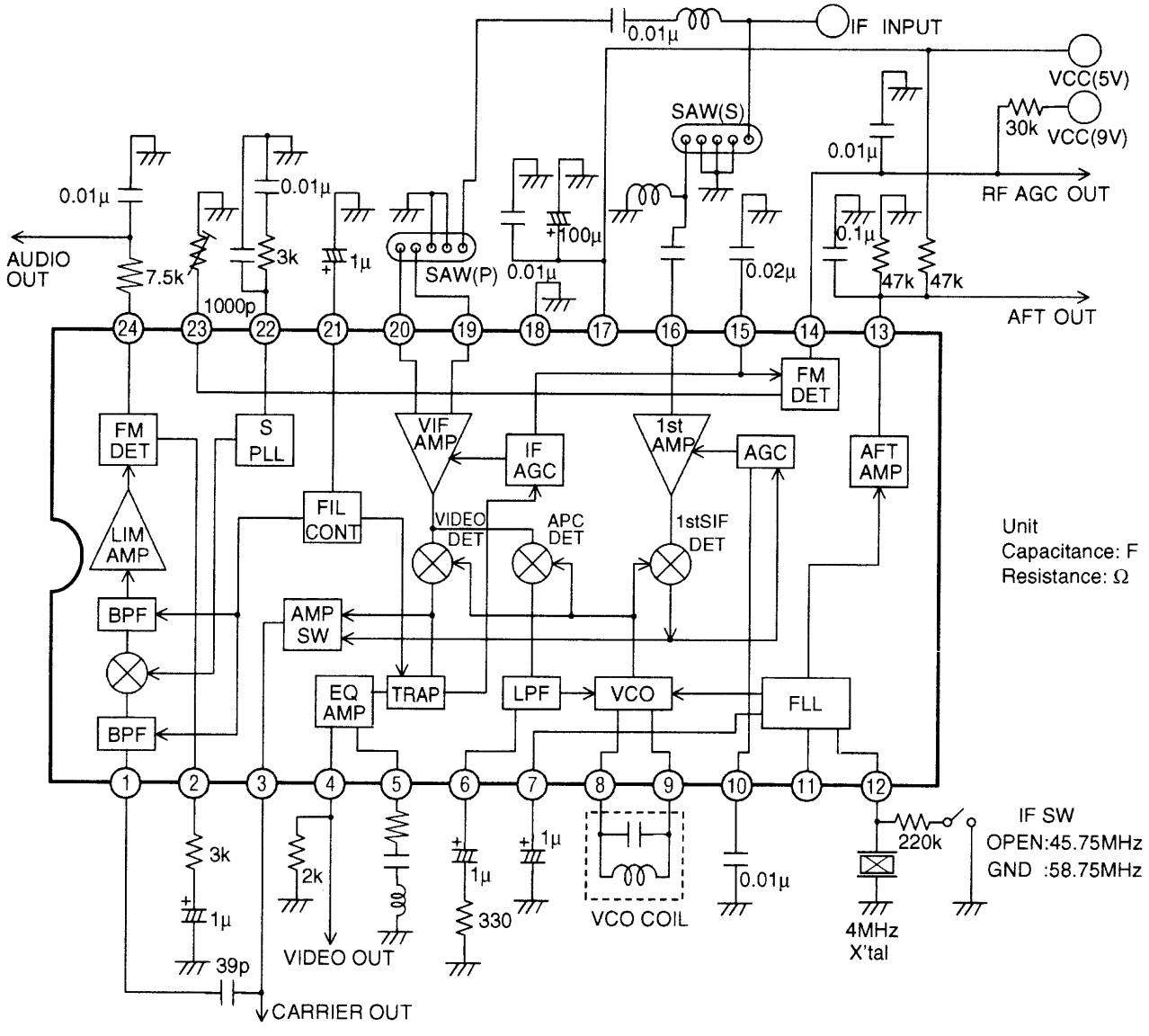
Pin No.	Pin	Pin Function	Internal Circuit
22	SIF PLL FILTER	Pin 22 is the SIF PLL filter pin. Normally use the following values. R: 3 kΩ C1: 0.01 μF C2: 1000 pF  ILA00560 When R is too large, the PLL may become unlocked, so use a resistance value within 6 kΩ. A smaller R value results in low-pass noise.	 ILA00559
23	RF AGC VR	Pin 23 is the RF AGC VR pin. When this pin is connected to GND, no signal is appeared on pin 4 and pin 24.	 ILA00561
24	FM DET OUT	Pin 24 is the FM output pin. Time constance of de-emphasis is determined by external C, R. Please chose C, R to make time constance 75 μs.	 ILA00562

Sample Application Circuit



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