Ordering number : ENN6804

Monolithic Linear IC

LA75503V

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

Overview

The LA75503V is an adjustment free VIF/SIF signal processing IC for PAL TV/VCR.

It supports 38 MHz, 38.9 MHz, and 39.5 MHz as the IF frequencies, as well as PAL sound multi-system (M/N, B/G, I, D/K), and contains an on-chip sound carrier trap and sound carrier BPF. 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

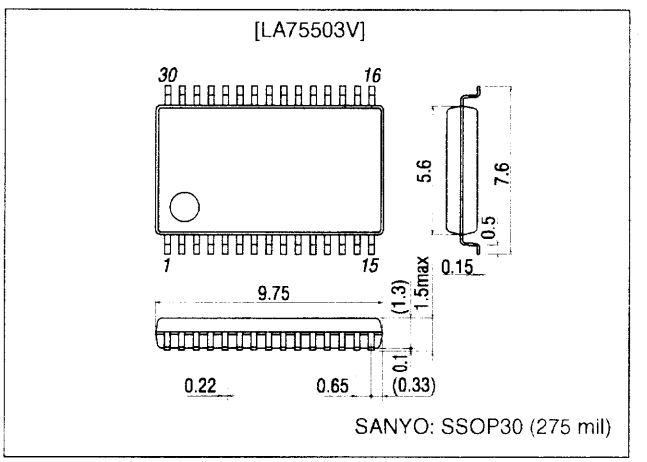
Features

- Internal VCO adjustment free circuit eliminating need for VCO coil adjustments.
- Internal sound carrier BPF and sound carrier trap enable easy configuration of PAL sound multi-system at low cost.
- Considerably reduces the number of required peripheral parts.
- Use of digital AFT eliminates problem of AFT tolerance.
- Package: SSOP30 (275 mil)

Package Dimensions

unit: mm

3191A-SSOP30 (275 mil)



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Specifications

Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_{CC} max		7	V
Circuit voltage	V16		V_{CC}	V
	V18		V_{CC}	V
Circuit current	I30		−1	mA
	I17		+0.5	mA
	I6		−10	mA
	I4		−3	mA
Allowable power dissipation	Pd max	Ta ≤ 70°C (*Mounted on a printed circuit board)	550	mW
Operating temperature	Topr		−20 to +70	°C
Storage temperature	Tstg		−55 to +150	°C

Note: * Circuit board dimensions: 65 × 72 × 1.6 mm^3, material: paper phenol.

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 = 38.9 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	B/G	48	52		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
Black noise threshold voltage	VBTH			0.7		V
Black noise clamp voltage	VBCL			1.8		V
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 = 38.9 MHz		±35	±70	kHz
AFT tolerance 2	dfa2	f = 38.0 MHz		±35	±70	kHz
AFT tolerance 3	dfa3	f = 39.5 MHz		±35	±70	kHz
AFT detection sensitivity	Sf	RL = 100 kΩ//100 kΩ	40	80	120	mV/kHz
AFT dead zone	fda			30	60	kHz
APC pull-in range (U)	fpu		1.5	2.0		MHz
APC pull-in range (L)	fpl		1.5	2.0		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

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Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
N trap1 (4.75 MHz)	NT1	wrt 1 MHz	–30	–35		dB
N trap2 (5.25 MHz)	NT2	wrt 1 MHz	–19	–24		dB
BG trap1 (5.75 MHz)	BT1	wrt 1 MHz	–27	–32		dB
BG trap2 (6.1 MHz)	BT2	wrt 1 MHz	–20	–25		dB
BG trap3 (5.85 MHz)	BT3	wrt 1 MHz	–27	–32		dB
I trap1 (6.25 MHz)	IT1	wrt 1 MHz	–25	–30		dB
I trap2 (6.8 MHz)	IT2	wrt 1 MHz	–15	–20		dB
DK trap1 (6.75 MHz)	DT1	wrt 1 MHz	–25	–30		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
Group delay 2 BG (4 MHz)	BGD2	wrt 1 MHz	30	60	90	ns
Group delay 2-1 BG (4.4 MHz)	BGD2-1	wrt 1 MHz	100	150	200	ns
Group delay 3 I (4 MHz)	IGD3	wrt 1 MHz	0	30	60	ns
Group delay 3-1 I (4.4 MHz)	IGD3-1	wrt 1 MHz	30	60	90	ns
Group delay 4 DK (4 MHz)	DGD4	wrt 1 MHz	0	15	30	ns
Group delay 4-1 DK (4.4 MHz)	DGD4-1	wrt 1 MHz	0	30	60	ns
[1st SIF Block]						
Conversion gain	Vg	fp = 5.5 MHz, Vi = 500μV	26	32	38	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 = 5.5 MHz, ΔF = ±30 kHz at 400 Hz	46	52	58	dBμV
FM detector output voltage	Vo(FM)		560	700	850	mVrms
AM rejection ratio	AMR	AM = 30% at 400 Hz	50	60		dB
Total harmonic distortion	THD	f = 5.5 MHz, ΔF = ±30 kHz		0.3	1.0	%
FM detector output S/N	S/N(FM)		55	60		dB
BPF 3-dB bandwidth	BW			±100		kHz
PAL de-emphasis	Pdeem	fm = 3 kHz		–3		dB
NTSC de-emphasis	Ndeem	fm = 2 kHz		–3		dB
PAL/NT audio voltage gain difference	GD			6		dB
[Others]						
4-MHz level (during external input)	X4MIN	Terminated	86			dBμ
SIF system SW threshold voltage	V10, V11			1.4		V
IF system SW threshold resistance	V12				270	kΩ
Split/inter SW	V16			0.5		V

System Switching

• SIF system switch

The SIF system is switched by setting pins A (pin 13) and B (pin 14) to GND or OPEN.

A	B	B/G	I	D/K	M/N	FM DET LEVEL	De-emphasis
GND	GND				O	6 dB	75 μs
GND	OPEN			O		0 dB	50 μs
OPEN	GND		O			0 dB	50 μs
OPEN	OPEN	O				0 dB	50 μs

Note: "O" indicates that the system is selected.

• IF system switch

38.9 MHz is selected as the IF frequency by leaving pin 15 (crystal oscillation) open. 38 MHz is selected by adding 220 kΩ between pin 15 and GND. This device can also select 39.5 MHz operation by adding a 220 kΩ resistor between pin 15 and V_{CC}.

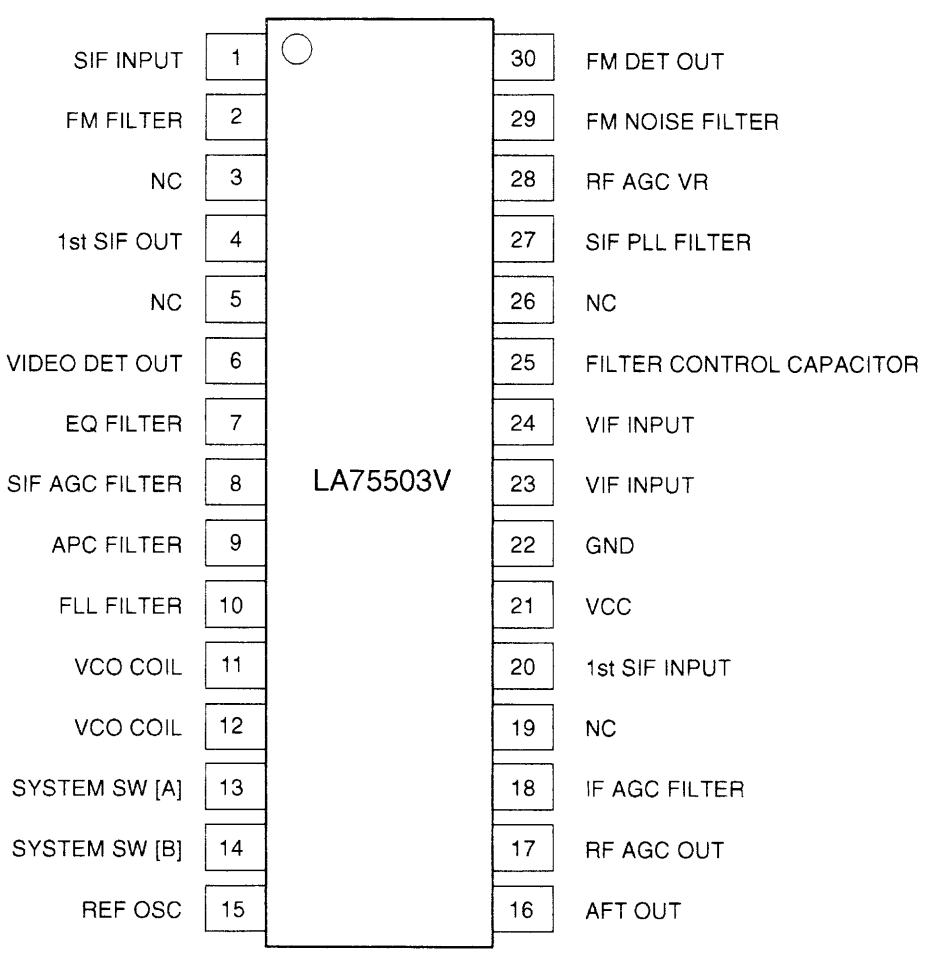
• Split/inter carrier switch

Inter carrier is selected by setting the first SIF input (pin 20) to GND.

Sound Trap

The trapping point of the sound trap is set approximately 250 kHz above the SIF center frequency of each mode to improve the video S/N. Therefore, design using split specifications is preferable.

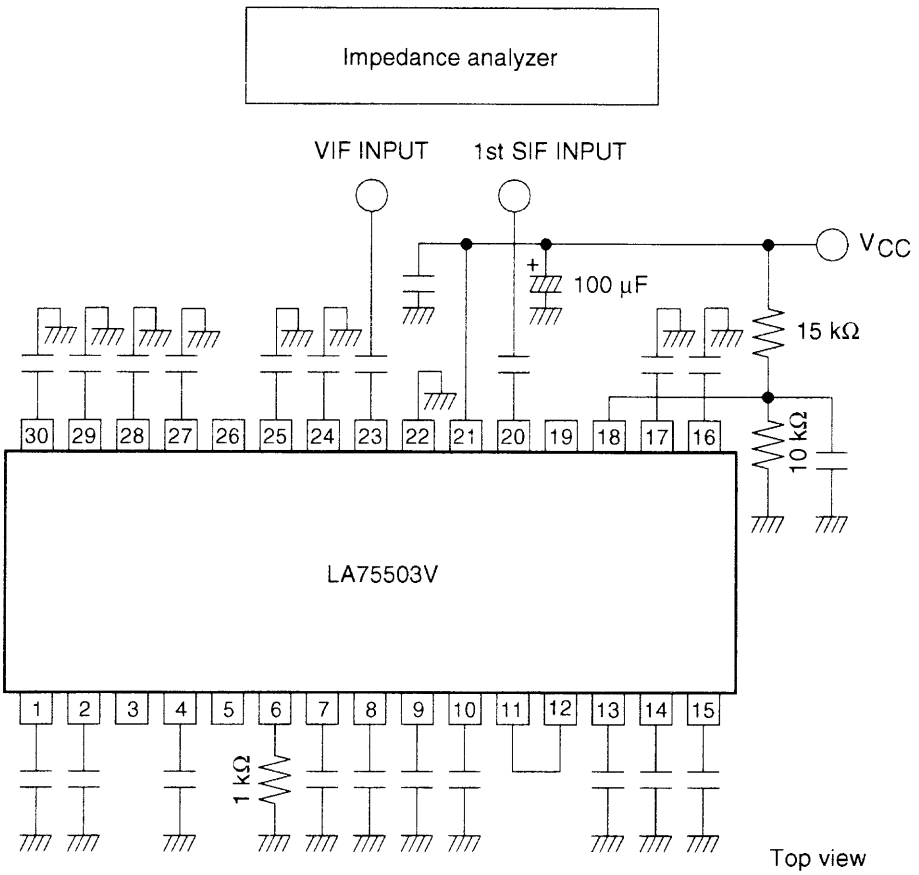
Pin Assignment



Top view

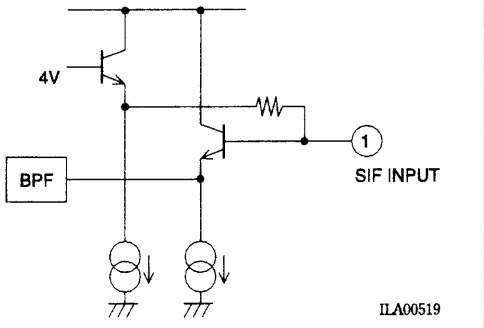
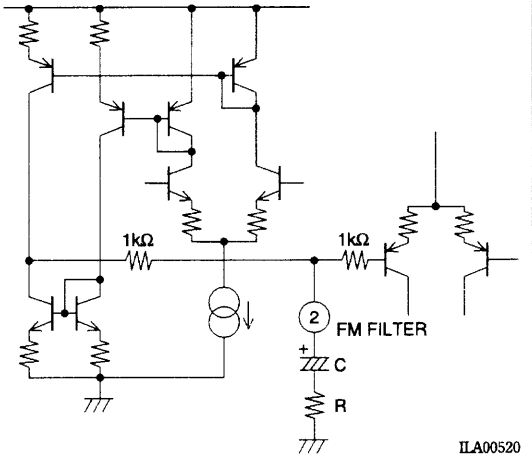
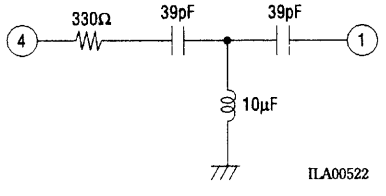
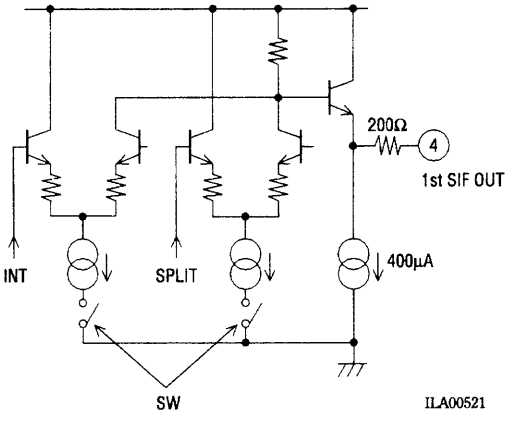
Test Circuit

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



*: 0.01 µF in case of unspecified capacitor

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	NC	Not connected	
4	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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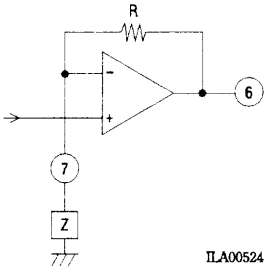
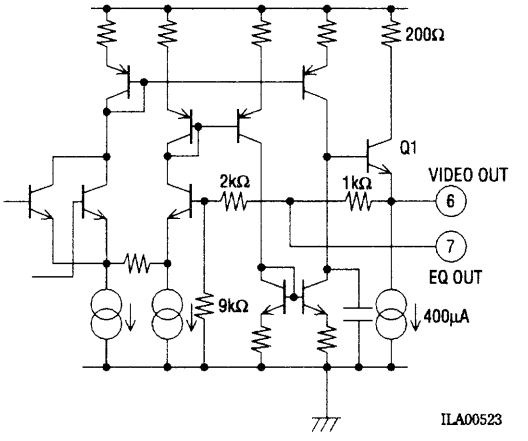
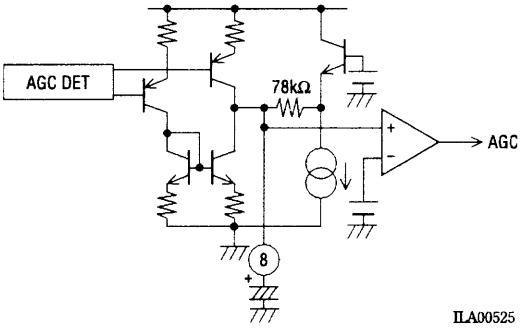
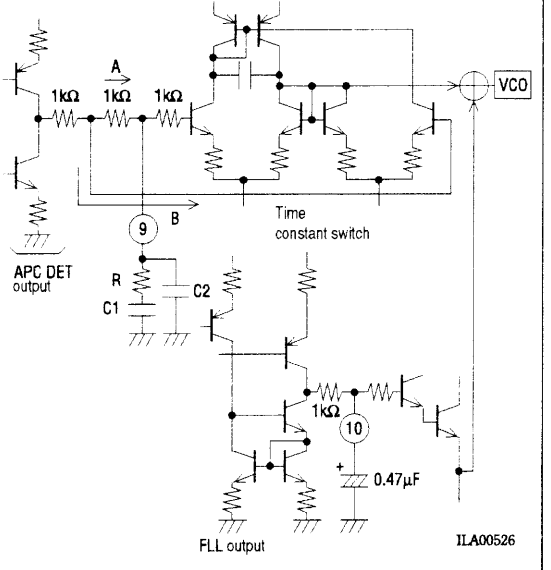
Pin No.	Pin	Pin Function	Internal Circuit
5	NC	Not connected	
6 7	VIDEO-OUT EQ-OUT	Pin 6 is the video output pin. The EQ amplifier can be thought of as shown below.  ILA00524 Therefore, the peak gain of the EQ amplifier is determined by Av = 1 + R/Z. However, note that the LA75503V being an IC with V_{CC} = 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.	 ILA00523
8	SIF AGC FILTER	Pin 8 is the SIF AGC filter pin. Use this pin with a capacitance between 0.01 μF and 0.1 μF.	 ILA00525
9 10	APC FILTER FLL FILTER	Pin 9 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 10 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 10 is 3.6 V.	 ILA00526

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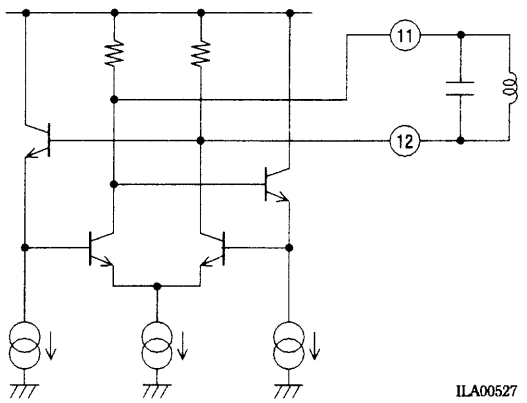
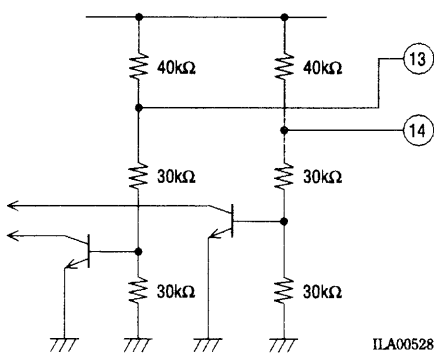
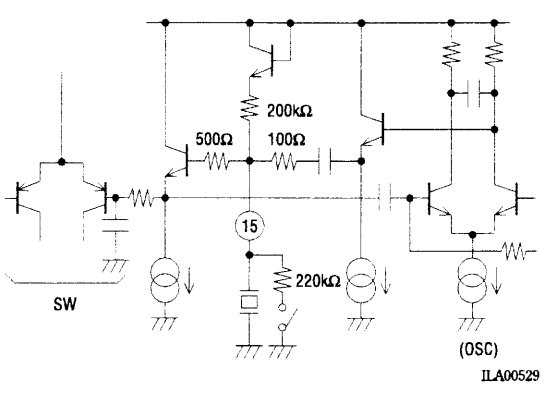
Pin No.	Pin	Pin Function	Internal Circuit
11 12	VCO COIL	This is the VCO tank circuit for the PLL detector. Use a tuning capacitance of 24 pF. Use L and C specifications that are accurate to ±2%. Also, design the L and C values so that the voltage of pin 10 is 3.6 V when PLL is locked while using the IF center frequency.	
13 14	SYSTEM SW	This is the system switch pin. The transistor turns ON when the pin voltage from the circuit becomes approx. 1.4 V.	
15	REF OSC	This pin can be used both as the crystal resonator pin and IF switch. The 38-MHz mode is selected by inserting 220 kΩ between pin 15 and GND, the 38.9 MHz mode by leaving the pin open, and the 39.5-MHz mode by inserting 220 kΩ between pin 15 and V_{CC}. 4-MHz input is possible from this pin. In the case of 4-MHz external input, input 86 dBμ or more.	

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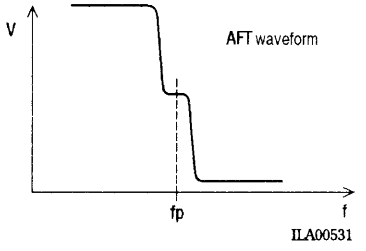
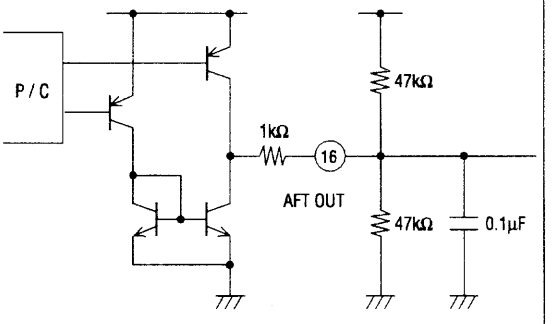
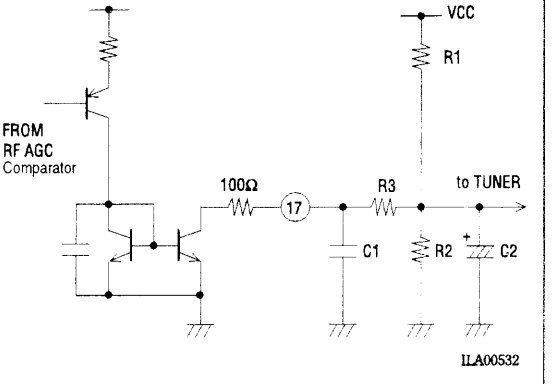
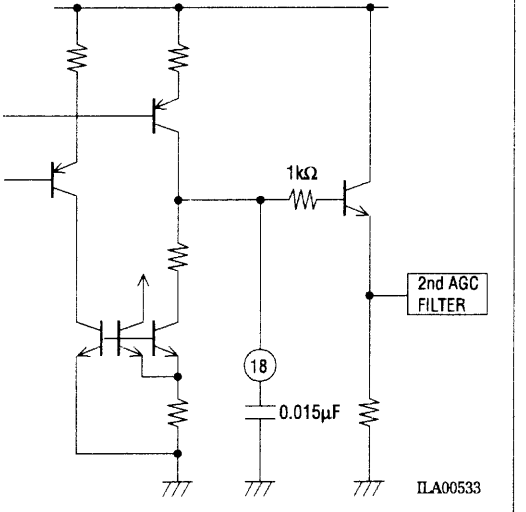
Pin No.	Pin	Pin Function	Internal Circuit
16	AFT OUT	Pin 16 is the AFT output pin. Use external resistors of 47 kΩ and a filter capacitance 0.1 μF. The AFT circuit generates the AFT voltage by comparing the signal obtained by dividing the 4-MHz reference frequency with the signal obtained by dividing VCO. Since it uses a digital phase comparator, a dead zone exists in the AFT center. 	
17	RF AGC OUT	Pin 17 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.	
18	IF AGC FILTER	Pin 18 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.	
19	NC	Not connected	

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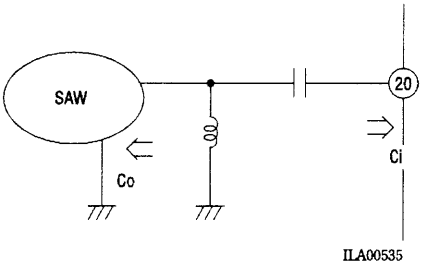
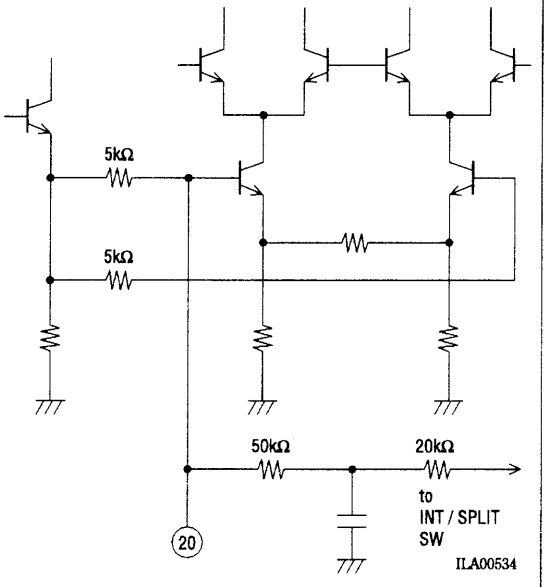
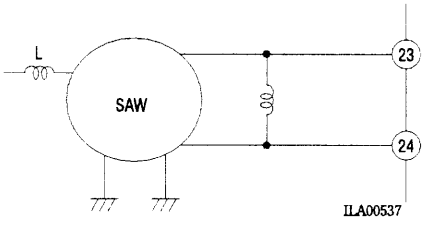
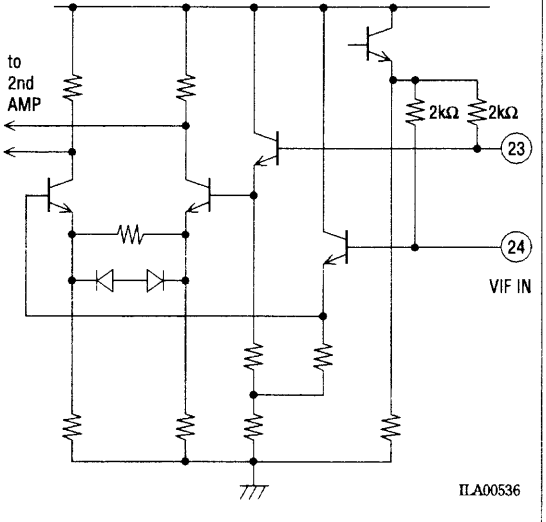
Pin No.	Pin	Pin Function	Internal Circuit
20	1st SIF INPUT	Pin 20 can be used both as the First SIF IN and inter/split switch pins. In the case of inter carrier, connect pin 20 to GND. When a sound saw filter is added, the matching loss can be decreased by inserting L to neutralize the IC input capacitance and saw filter output capacitance.  ILA00535	 ILA00534
21	V_{CC}	Connect the decoupling capacitor as close as possible.	
22	GND		
23 24	VIF INPUT	Pins 23 and 24 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.  ILA00537	 ILA00536

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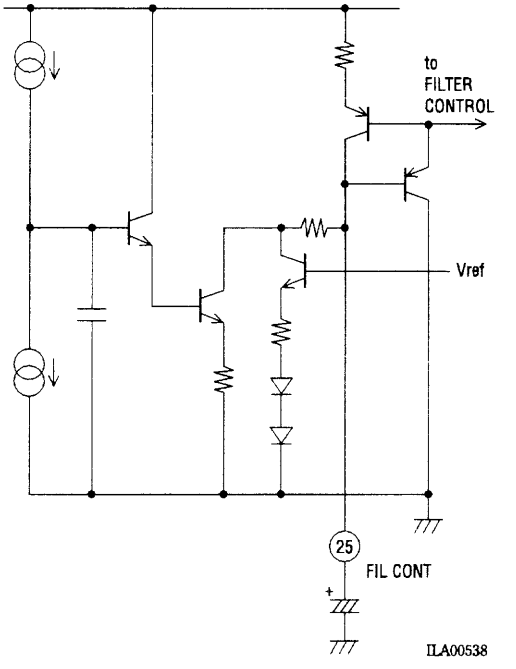
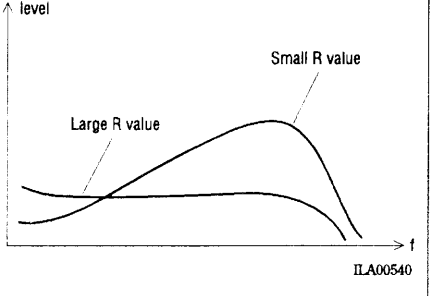
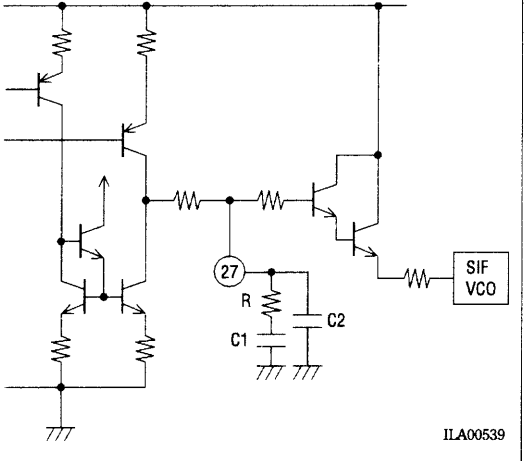
Pin No.	Pin	Pin Function	Internal Circuit
25	FILTER CONTROL CAPACITOR	Internal filters (i.e. sound carrier BPF and sound carrier trap) are tuned using the capacitor connected to pin 25. A value between 0.47 µF and 1 µF is considered desirable taking video S/N, and AM and PM noise into consideration.	
26	NC	Not connected	
27	SIF PLL FILTER	Pin 27 is the SIF PLL filter pin. Normally use the following values. R: 3 kΩ C1: 0.01 µF C2: 1000 pF  A large R value (6 kΩ or lower) results in high-pass FM detection output noise. A smaller R value results in low-pass noise.	

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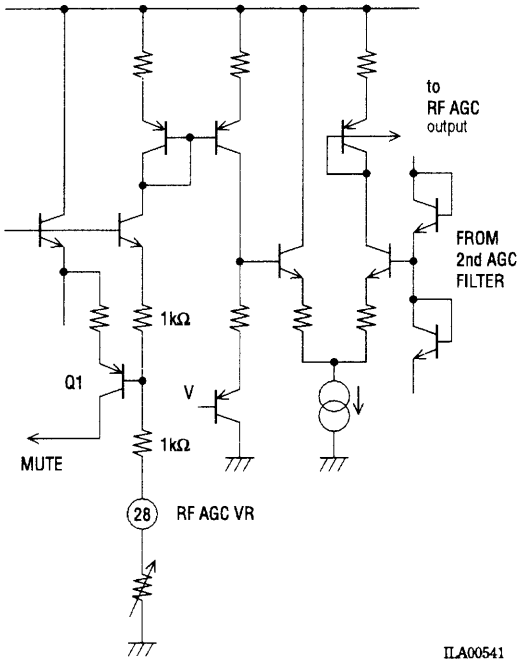
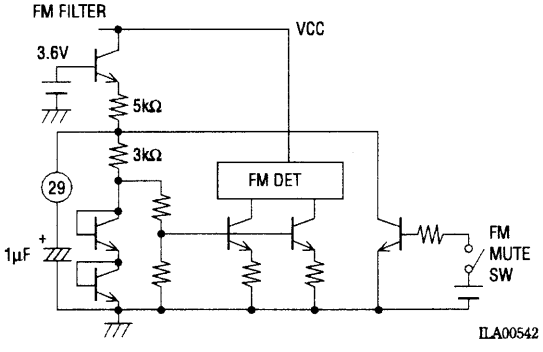
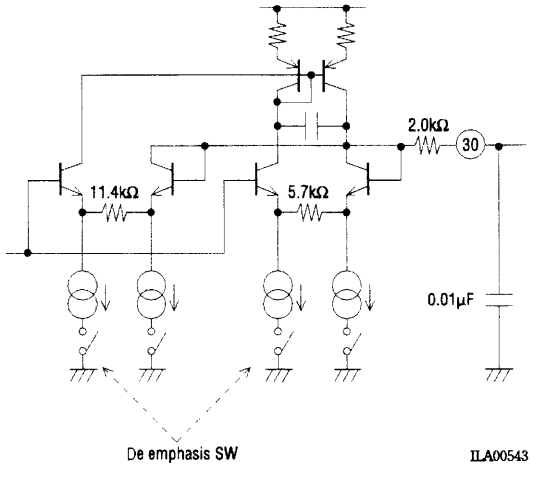
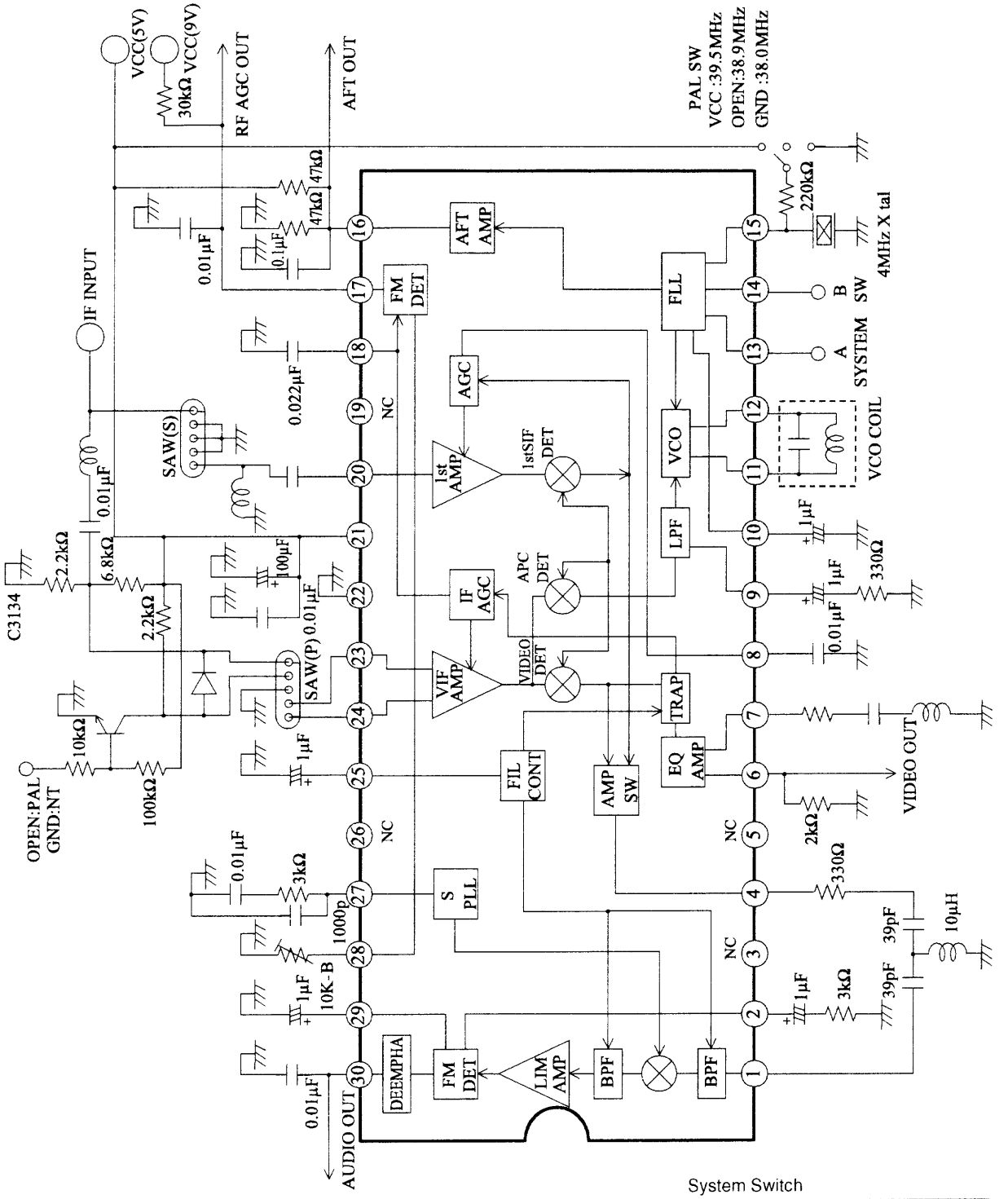
Pin No.	Pin	Pin Function	Internal Circuit
28	RF AGC VR	Pin 28 is the RF AGC VR pin. When this pin is connected to GND, no signal is appeared on pin 6 and pin 30.	
29	FM FILTER	Pin 29 is the FM filter pin. Use a capacitance between 0.01 µF and 1 µF.	
30	FM DET OUT	Pin 30 is the FM output pin. The built-in differential amplifier determines and switches the de-emphasis resistance value. PAL: 5 k × 0.01µF NT: 7.5 k × 0.01 µF	

Sample Application Circuit



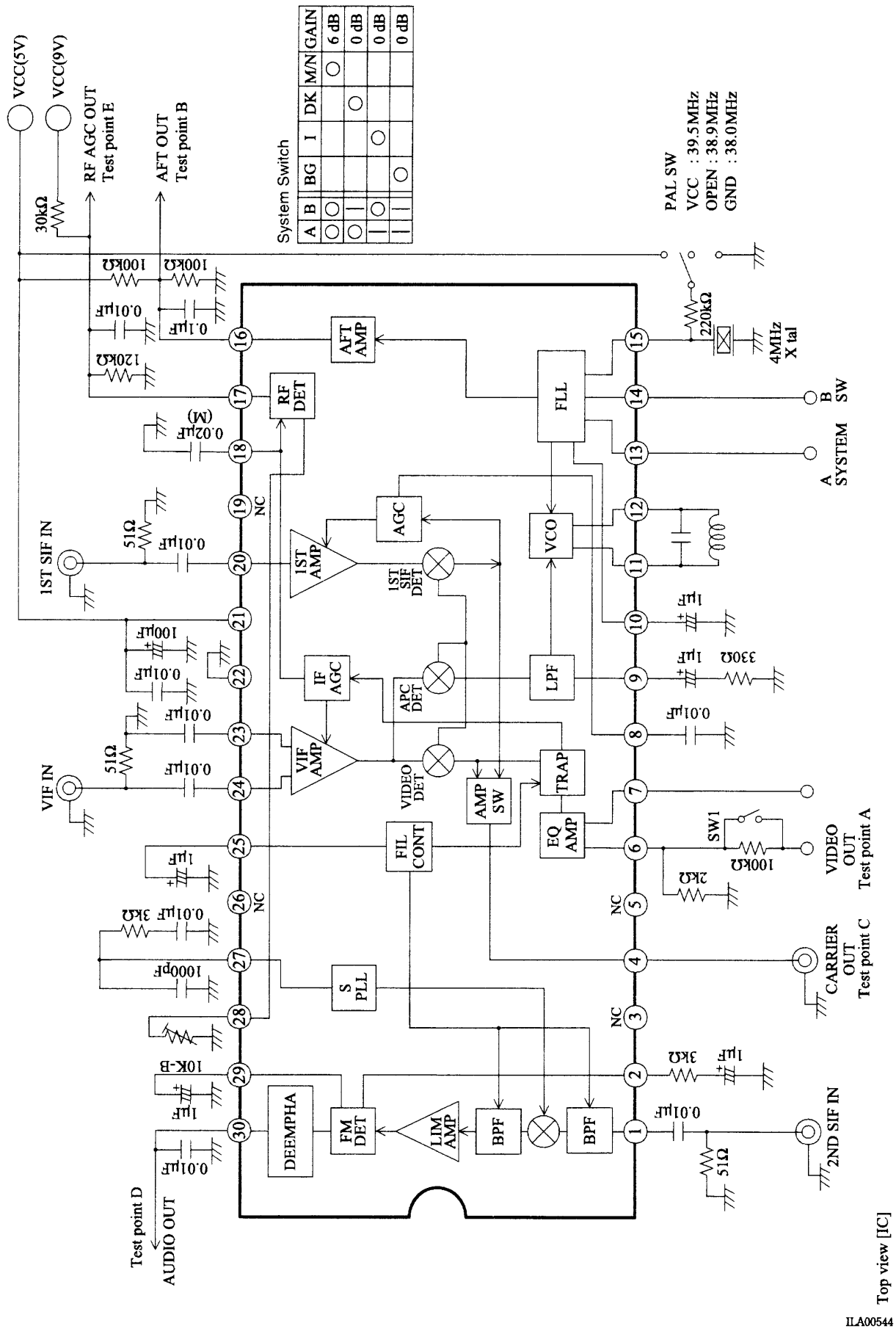
System Switch

A B	BG	I	DK	MN	GAIN
0 0				○	6 dB
0 1			○		0 dB
1 0		○			0 dB
1 1	○				0 dB

1: OPEN

0: GND

Test Circuit



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