Ordering number : ENA0789

SANYO Semiconductors
DATA SHEET

LA75501 —

Monolithic Linear IC
For Use in TV/VCR Applications
VIF/SIF Signal Processing IC

Overview

The LA75501 is an adjustment free VIF/SIF signal processing IC for PAL TV/VCR. It supports 38MHz, 38.9MHz, and 39.5MHz 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, 4MHz external crystal or 4MHz external signal is needed.

Function

- VIF Block: VIF Amplifier, PLL Detector, IF AGC, RF AGC, Equalizer, amplifier, Buzz Canceller, SIF Trap, Digital AFT, FLL, 4MHz X'tal oscillation
- 1st SIF Block: 1st SIF Amplifier, 1st SIF Detector, 1st SIF AGC
- SIF Block: Limiter Amplifier Down Converter, PLL FM Detector SIF PLL SIF VCO, SIF BPF
- Others: IF SW (38.9MHz, 38MHz), SIF4 System SW (B/G, I, D/K, M/N), IFAGC 2nd filter

Specifications

Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum Supply voltage	V_{CC}		7	V
Circuit voltage	V_{13}		V_{CC}	V
	V_{15}		V_{CC}	V
Circuit Current	I_{24}		-1	mA
	I_{14}		+0.5	mA
	I_4		-10	mA
	I_3		-3	mA
Allowable power dissipation	Pd max	Ta≤50°C	470	mW
Operating temperature	Topr		-20 to +70	°C
Storage temperature	Tstg		-55 to +150	°C

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Operating Ranges at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	V_{CC}		5.0	V
Operating supply voltage	V_{CC} op		4.5 to 6.0	V

Electrical Characteristics at Ta = 25°C, V_{CC} = 5V, fp = 38.0MHz

VIF Block

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Circuit current	I_{17}			64.0	73.6	mA
Maximum RF AGC voltage	$V_{14}H$	Collector load 30kΩ VC2 = 9V	8.5	9		V
Minimum RF AGC voltage	$V_{14}L$			0.3	0.7	V
Input sensitivity	vi		33	39	45	dBμV
AGC range	GR		58			dB
Maximum allowable input	Vi max		92	97		dBμV
No-signal video output voltage	V_4		3.3	3.6	3.9	V
Sync. Signal tip voltage	V_4tip		1.0	1.3	1.6	V
Video output amplitude	V_O		1.7	2.0	2.3	Vp-p
Video S/N	S/N	B/G	48	52		dB
C-S best	IC-S	P/S = 10dB	26	32	38	dB
Differential gain	DG	V_{IN} = 0dBμ, 87.5% MOD		3	6	%
Differential phase	DP			2	10	deg
Black noise threshold voltage	V_{BTH}			0.7		V
Black noise clamp voltage	V_{BCL}			1.8		V
VIF input resistance	R_i			2.5	3.0	kΩ
VIF input capacitance	C_i			3	6	PF
Maximum AFT voltage	$V_{16}H$		4.3	4.7	5.0	V
Minimum AFT voltage	$V_{16}L$		0	0.2	0.7	V
AFT tolerance 1	dfa1	f = 38.9MHz		±15	±25	KHz
AFT tolerance 2	dfa2	f = 38.0MHz		±15	±25	KHz
ATF detection sensitivity	sf	R_L = 100k//100KΩ	30	55	80	mV/kHz
AFT Dead Zone	fda			30	60	MHz
AFT leak current	AFTL				±4.0	μA
APC pull-in range (U)	fpu		1.5	2.0		MHz
APC pull-in range (L)	fpl		1.5	2.0		MHz
VCO maximum variable range (U)	dfu		1.5	2.0		MHz
VCO maximum variable range (L)	dfl		1.5	2.0		MHz
VCO control sensitivity	β		2.0	4.0	8.0	kHz/mV
N Trap 1 (4.5M)	NT1		-30	-35		dB
N Trap 2 (4.8M)	NT1-1		-19	-24		dB
B/G Trap 1 (5.5M)	BT1		-27	-32		dB
B/G Trap 2 (5.85M)	BT1-1		-20	-25		dB
I Trap 1 (6.0M)	IT1		-25	-30		dB
I Trap 2 (6.55M)	IT1-1		-15	-20		dB
D/K Trap1 (6.5M)	DT1		-25	-30		dB
Group delay 1 NTSC (3.0M)	ngd1		30	60	90	ns
Group delay 1-1 NTSC (3.5M)	ngd1-1		160	230	300	ns
Group delay 2 B/G (4M)	bgd2		70	100	130	ns
Group delay 2-1 B/G (4.4M)	bgd2-1		160	230	300	ns
Group delay 3 I (4M)	bgd3		20	50	80	ns
Group delay 3-1 I (4.4M)	bgd3-1		60	90	120	ns
Group delay 4 D/K (4M)	bgd4		0	30	60	ns
Group delay 4-1 D/K (4.4M)	bgd4-1		10	40	70	ns

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Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Video f-characteristics MN1	VFMN1	M/N 1 to 2MHz	-1.0	0.0	1.0	dB
Video f-characteristics MN2	VFMN2	M/N 2 to 3MHz	0.0	1.0	2.0	dB
Video f-characteristics MN3	VFMN3	M/N 3.58MHz	0.5	2.0	3.5	dB
Video f-characteristics BG1	VFBG1	B/G 1 to 3MHz	-1.0	0.0	1.5	dB
Video f-characteristics BG2	VFBG2	B/G 3 to 4MHz	0.0	1.5	3.0	dB
Video f-characteristics BG3	VFBG3	B/G 4.43MHz	1.0	2.5	4.0	dB
Video f-characteristics I1	VFI1	I 1 to 3MHz	-1.0	0.0	1.5	dB
Video f-characteristics I2	VFI2	I 3 to 4MHz	0.0	1.0	2.0	dB
Video f-characteristics I3	VFI3	I 4.43Hz	0.5	2.0	3.5	dB
Video f-characteristics DK1	VFDK1	D/K 1 to 3MHz	-1.0	0.0	1.5	dB
Video f-characteristics DK2	VFDK2	D/K 3 to 4MHz	0.0	1.0	2.0	dB
Video f-characteristics DK3	VFDK3	D/K 4.43MHz	0.0	1.5	3.0	dB

1st SIF Block

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Conversion gain	V_G	fp-5.5MHz,Vi = 500μV	26	32	36	dB
SIF carrier output level	S_O	Vi = 10mV		100		mVrms
1st SIF maximum input	Si max	S_O±2dB		106		dBμV
1st SIF input resistance	R_is			2.0	2.4	KΩ
1st SIF input capacitance	C_is			3	6	PF

SIF Block

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Limiting sensitivity	Vi (lim)	f = 5.5MHz ΔF = ±30kHz at 400Hz	46	52	58	dBμV
FM detector output voltage	V_O (FM)		480	600	750	mVrms
AM rejection ratio	AMR	AM = 30% at 400Hz	50	60		dB
Distortion	THD	f = 5.5MHz ΔF = ±30kHz		0.3	1.0	%
FM detector output S/N	S/N (FM)	DIN. Audio	55	60		dB
BPF 3dB band width	BW			±100		kHz
PAL de-emphasis	Pdeem	fm = 3kHz		-3		dB
NTSC de-emphasis	Ndeem	fm = 2kHz		-3		dB
PAL/NT Audio voltage gain difference	GD			6		dB

Others

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Minimum 4MHz level (at external input)	X_4MIN	Terminal value	80	86	92	dBμ
SIF system SW threshold voltage	V_{10} V_{11}			1.4		V
IF system SW threshold voltage	V_{12}				270	KΩ
Split/Inter SW	V_{16}			0.5		V

System Changeover

SW/SIF system SW

The SIF system can be changed over by setting A (pin 13) and B (pin 14) to GND and the open state respectively.

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

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

IF system SW

The IF frequency is selected 38.9MHz mode with the pin 12 (crystal oscillation) open.
The IF frequency is selected 38MHz mode by adding 220KΩ between the pin 12 and GND.

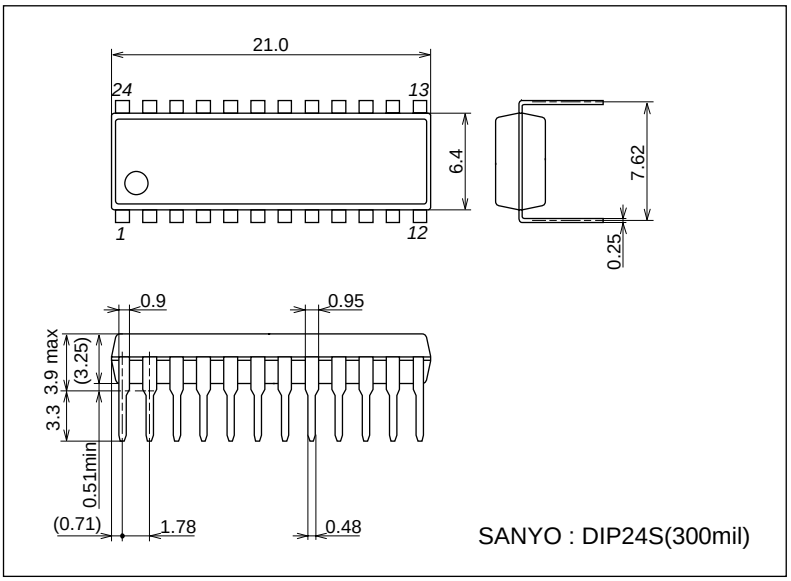
Inter carrier SW

Inter-carrier is selected by setting the 1st SIF input (pin 16) to GND.

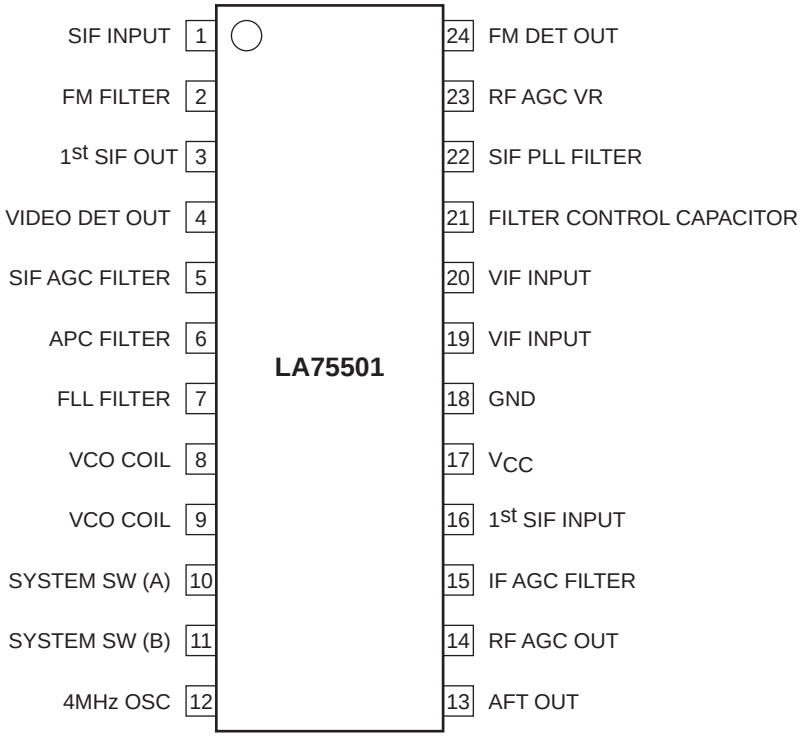
Package Dimensions

unit : mm

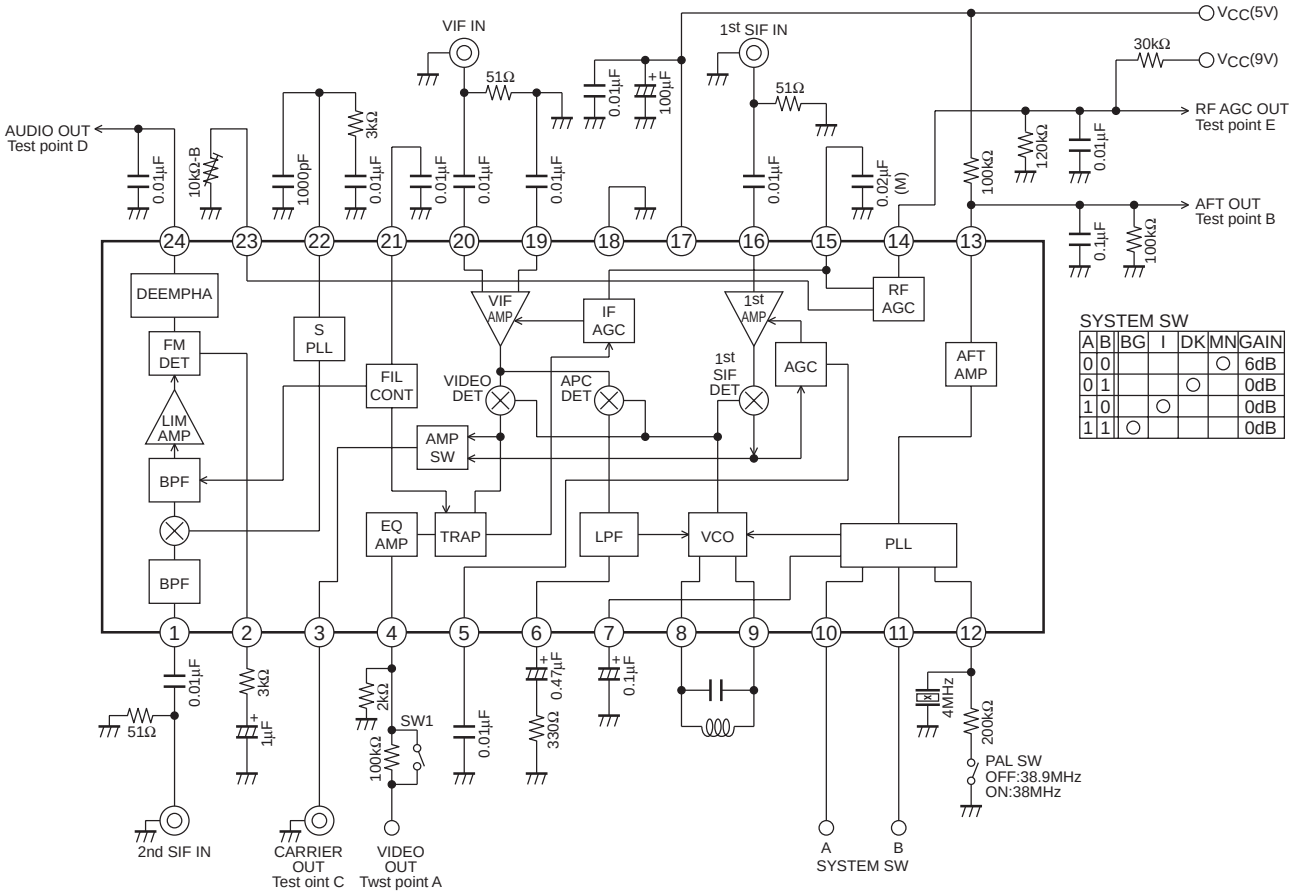
3067B



Pin Assignment



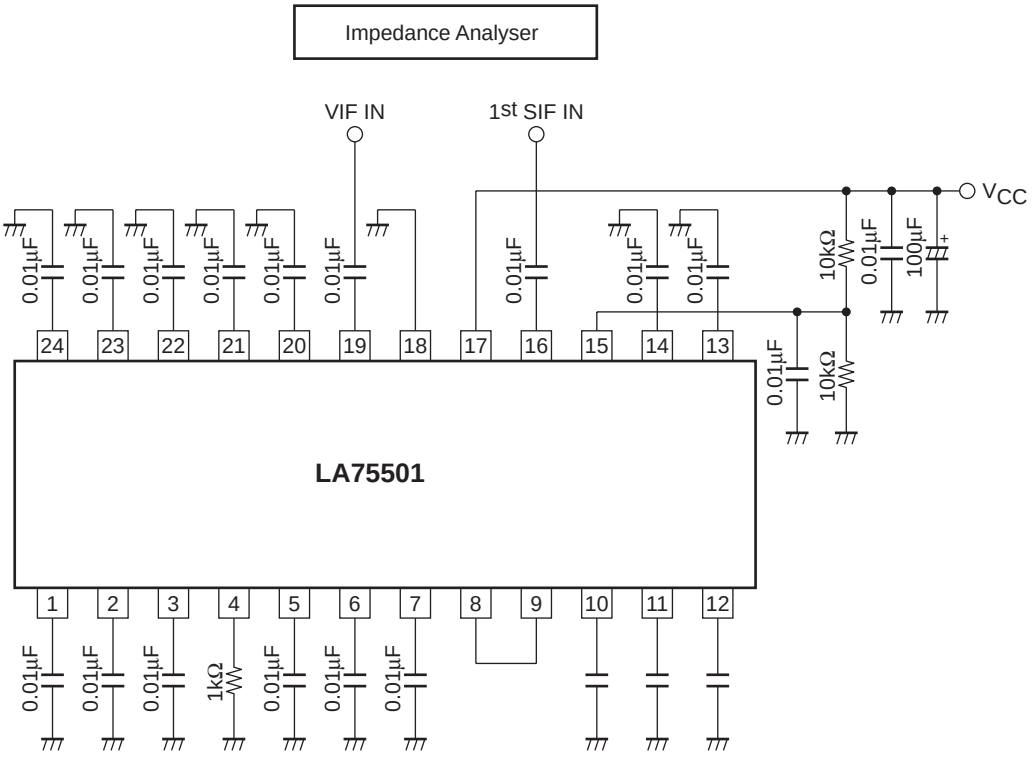
Block Diagram and AC Characteristics Test Circuit



SYSTEM SW

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

Input Impedance Test Circuit



Test Conditions

V1. Circuit current [I_{17}]
(1) External AGC (V_{17} = 1.5V)
(2) RF AGC VR MAX
(3) Connect an ammeter to the V_{CC} and measure the incoming current to pin 17.

V2. V3. Maximum RF AGC voltage, Minimum RF AGC voltage [$V_{14}H$, $V_{14}L$]
(1) Internal AGC
(2) Input a 38.0MHz, 10mVrms, continuous wave to the VIF input pin.
(3) Adjust the RF AGC VR (resistance max.) and measure the maximum RF AGC voltage.
(4) Adjust the RF AGC VR (resistance min.) and measure the minimum RF AGC voltage.
(3), (4) Measuring point F

V4. Input sensitivity [Vi]
(1) Internal AGC
(2) fp = 38.0MHz 400Hz 40% AM (VIF input)
(3) Turn off the SW1 and put 100kΩ through.
(4) Measure the VIF input level at which the 400Hz detection output level at test point A becomes 0.7Vp-p.

V5. AGC range [GR]
(1) Apply the V_{CC} voltage to the external AGC, If AGC (pin 15).
(2) In the same manner under the same conditions as for V4 (input sensitivity), measure the VIF input level at which the detection output level becomes 0.7Vp-p. ····· Vil
(3) $GR = 20\log \frac{Vil}{Vi}$ dB *Vi: Input sensitivity

V6. Maximum allowable input [Vi max]
(1) Internal AGC
(2) fp = 38.0MHz 15kHz 78% AM (VIF input)
(3) VIF input level at which the detection output level at test point A becomes video output (V_O) ±1dB.

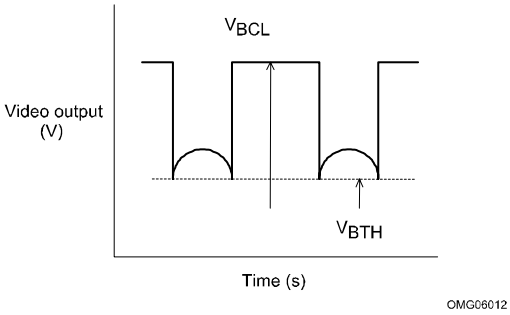
V7. No-signal video output voltage [V_4]
(1) Apply the V_{CC} voltage to the external AGC, IF AGC (pin 15).
(2) Measure the DC voltage of VIDEO output (A).

V8. Sync. signal tip voltage [V_6tip]
(1) Internal AGC
(2) Input a 38.0MHz, 10mVrms, continuous wave to the VIF input pin.
(3) Measure the DC voltage of VIDEO output (A).

V9. Video output level [V_O]
(1) Internal AGC
(2) fp = 38.0MHz 15kHz 78% AM
Vi = 10mVrms (VIF input)
(3) Measure the peak value of the detection output level at test point A. (Vp-p)

V10.V11. Black noise threshold and clamp voltage [V_{BTH}, V_{BCL}]

(1) Apply DC voltage (1 to 3V) to the external AGC, IF AGC (pin 15) and adjust the voltage.
(2) fp = 38.0MHz 400Hz 40% AM 10mVrms (VIF input)
(3) Adjust the IF AGC (pin 15) voltage to operate the noise canceller.
Measure the V_{BTH}, V_{BCL} at test point A.



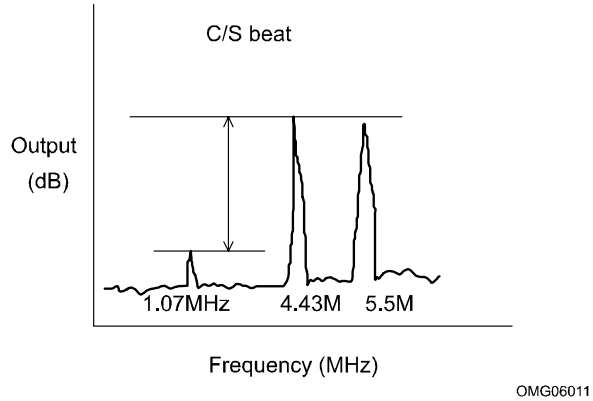
V12. Video S/N [S/N]

(1) Internal AGC
(2) fp = 38.0MHz CW = 10mVrms (VIF input)
(3) Measure the noise voltage at test point A in RMS volts through a HPF: 100kHz, LPF: 5MHz filter.
····· Noise voltage (N)

(4) $S/N = 20\log \frac{\text{Video voltage (Vp-p)}}{\text{N (Vrms)}} = 20\log \frac{1.3\text{Vp-p}}{\text{N(Vrms)}}$ (dB)

V13. C/S beat [Ics]

(1) Internal AGC.
(2) fp = 38.0MHz APL50% 87.5% Modulation video signal.
(3) Measure the difference between the levels for 4.43MHz and 1.07MHz components at test point A.

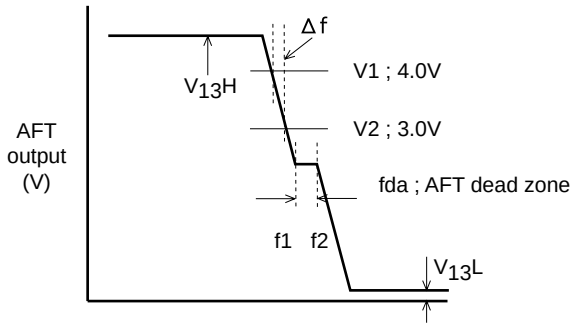


V14.V15. Differential gain, differential phase [DG, DP]

(1) Internal AGC
(2) fp = 38.0MHz APL50% 87.5% Modulation video signal Vi = 10mVrms
(3) Measure the DG and DP at test point A.

V16. V17.V18 Maximum, minimum AFT voltage [$V_{13}H$, $V_{13}L$]

(1) Internal AGC
(2) fp = 38.0MHz ±1.5MHz Vi = 10mVrms (VIF input)
(3) Measure maximum and minimum AFT output voltage by changing the input frequency.
(4) Maximum voltage: $V_{13}H$, minimum voltage: $V_{13}L$.



V19.V20.V21. AFT detector sensitivity, AFT Dead Zone, AFT tolerance [dfa, Sf, fda]

(1) Measure the frequency deviation when the voltage at the measuring point B changes from V1 to V2. ·····Δf

$$Sf\ (mV/kHz) = \frac{V1-V2}{\Delta f}$$

(2) Measure the width in which the voltage at the measuring point B does not change.
(3) Calculate as follows:
fda (kHz) = f2 – f1
(4) Calculate as follows:
IF Center frequency: 38.9MHz, 38MHz

$$dfa\ (kHz) = fc - \frac{f1 + f2}{2}$$

V23. V24. VIF input resistance, input capacitance [R_i, C_i]

(1) External AGC (V_{15} = 2V)
(2) Referring to the Input Impedance Test Circuit, measure R_i and C_i with an impedance analyzer.

V25.V26. APC pull-in range [fpu, fpl]

(1) Internal AGC
(2) fp = 33MHz to 44MHz CW;10mVrms
(3) Adjust the SG signal frequency to be higher than fp = 38.0MHz to bring the PLL to unlocked state.
Note; The PLL is taken as in unlocked state when a beat signal appears at test point A.
(4) When the SG signal frequency is lowered, the PLL is brought to locked state again. ····· f1
(5) Lower the SG signal frequency to bring the PLL to unlock state.
(6) When the SG signal frequency is raised, the PLL is brought to locked state again. ····· f2
(7) Calculate as follows:
fpu = f1 – 38.0MHz
fpl = f2 – 38.0MHz

V27.V28. VCO maximum variable range (U, L) [dfu, dfl]

(1) Apply the V_{CC} voltage to the external AGC, IF AGC (pin 15).
(2) fl is taken as the frequency when 1V is applied to the APC pin (pin 7). In the same manner, fu is taken as the frequency when 5V is applied to the APC pin (pin 7).
dpu = fu – 38.0MHz
dfl = fl – 38.0MHz

V29. VCO control sensitivity [β]

(1) Apply the V_{CC} voltage to the external AGC, IF AGC (pin 15).
(2) Apply the 3V to the external FLL, FLL (pin 10).
(3) Pick up the VCO oscillation frequency from the VIDEO output (A), GND, etc.
And adjust the VCO coil so that the frequency becomes 38.0MHz.
(4) f1 is taken as the frequency when 2.8V is applied to the APC pin (pin 7).
In the same manner, f2 is taken as the frequency when 3.2V is applied to the APC pin (pin 7).

$$\beta = f2 - \frac{f1 - f2}{400} \quad (kHz/mV)$$

F1. 1st SIF conversion gain [V_G]

(1) Internal AGC
(2) fp = 38.0MHz CW;10mV (VIF input)
fs = 32.5MHz CW;500μV (1st SIF input) ····· V1
(3) measure the detection output level at test point C (5.5MHz) ····· V2

(4) $V_G = 20\log \frac{V2}{V1}$ dB

F2. 5.5MHz output level [S_O]

(1) Internal AGC
(2) fp = 38.0MHz CW; 10mV (VIF input)
fs = 32.5MHz CW; 10mV (1st SIF input) ····· V1
(3) Measure the detection output level at test point C (5.5MHz). ····· S_O (mVrms)

F3. 1st maximum input [Si max]

(1) Internal AGC
(2) fp = 38.0MHz CW; 10mV (VIF input)
fs = 32.5MHz CW; Variable (1st SIF input)
(3) Input level at which the detection output (5.5MHz) at test point C becomes S_O ±2dB. ····· Si max

F4.F5. 1st SIF input resistance, input capacitance [R_i (SIF1), C_i (SIF1)]

(1) Referring to the Input Impedance Test Circuit, measure R_i and C_i with an impedance analyzer.

S1. SIF Limiting sensitivity [V_i (lim)]

(1) Apply the V_{CC} voltage to the external AGC, IF AGC (pin 15).
(2) fs = 5.5MHz fm = 400Hz ΔF = ±300kHz (SIF input)
(3) Set the SIF input level to 31.6mVrms and measure the level at test point D. ····· V1
(4) Lower the SIF input level and measure the input level which becomes V1. ····· 3dB.

S2.S4. FM detection output voltage, total harmonics distortion [V_O(FM), THD]

(1) Apply the V_{CC} voltage to the external AGC, IF AGC (pin 15).
(2) fs = 5.5MHz fm = 400Hz Δf = ±30kHz
(SIF input Vi = 31.6mVrms)
(3) Measure the FM detection output voltage, total harmonics distortion at test point D.

S3. AM rejection ratio [AMR]

(1) External AGC (V_{15} =V_{CC})
(2) fs = 5.5MHz fm = 400Hz AM = 30%
(SIF input Vi = 31.6mVrms)
(3) Measure the output level at test point D. ····· VAM

(4) $AMR = 20\log \frac{V_O\,(DET)}{VAM}$ dB

S5. SIF S/N [S/N (FM)]

(1) External AGC (V_{15} = V_{CC})
(2) fs = 5.5MHz NO MOD Vi = 31.6mVrms
(3) Measure the output level at test point D. ····· Vn

(4) S/N = $20\log \frac{V_O\,(DET)}{Vn}$ dB

S6. PAL/NT Audio voltage gain difference [GD]

(1) External AGC (V_{15} =V_{CC})
(2) fs = 4.5MHz fm = 400Hz ΔF = ±30kHz
(SIF input Vi = 31.6mVrms)
(3) Set system switches [A (pin 10) and B (pin 11)] to GND.
(4) Measure the FM detector output voltage at test point D. ····· Vnt
(5) Calculate as follows:
GD (db) = Vnt – V_O (FM)

S7.S8. PAL, NT de-emphasis [Pdeem, Ndeem]

(1) External AGC (V_{15} = V_{CC})
(2) fs = 5.5MHz fm = 3kHz ΔF = ±30kHz
(SIF input Vi = 31.6mVrms)
(3) Open system switches (A (pin 10) and B (pin 11)). (BG mode)
(4) Measure the FM detector output voltage at test point D. ····· Vp
(5) Calculate as follows:
Pdeem (dB) = Vp – V_O (FM)
(6) fs = 4.5MHz fm = 2kHz ΔF = ±30kHz
(SIF input Vi = 31.6mVrms)
(7) Set system switches [A (pin 10) and B (pin 11)] to GND. (NT mode)
(8) Measure the FM detector output voltage at test point D. ····· Vp
(9) Calculate as follows:
Ndeem (dB) = Vnt – V_O (FM)