


LA7425

NTSC Format Single-Chip Signal Processing IC for VHS VCR Products

Overview

The LA7425 is a single-chip video signal processing IC for use in VHS format VCR products. The number of required adjustments has been reduced to a single adjustment by IC chip internal trimming. The incorporation of a playback equalizer and other circuits on chip provides a significant reduction in external components and thus significantly reduces the cost of manufacturing the signal processing printed circuit board. This product can also support simplified S-VHS playback, which is becoming a standard feature in VCR products in the Japanese market.

Features

- Only one adjustment point (comb filter phase adjustment)
(The AGC, carrier, deviation and PB-Y level are adjustment free.)
(If an LA7411/16 is used as the head amplifier, the Y/C record current will also be adjustment free.)
- Simplified S-VHS playback support
 - Built-in S-VHS discrimination circuit
 - Built-in equalizer switch
 - Automatic demodulator gain switching
 - Internal automatic de-emphasis characteristics switching
- Only a minimal number of external components required (85 components: This corresponds to a 38% reduction over previous Sanyo products ... CNR and SQPB not handled, and REC EQ not included.)
Components newly incorporated on chip:
 - Playback equalizer (include chroma trap), limiter balance filter, capacitor and resistor for detail enhancer, record chroma 7.8 MHz trap, playback chroma LPF, ACC filter
- High performance/multifunctionality
 - Linear phase type picture controller
 - Double high-pass noise canceller, high-speed AFC, DCC
 - New built-in functions
 - FM AGC, synchronization detection circuit, linear control circuit for high-pass noise canceller,

playback mode Y/C separator output, chroma noise canceller

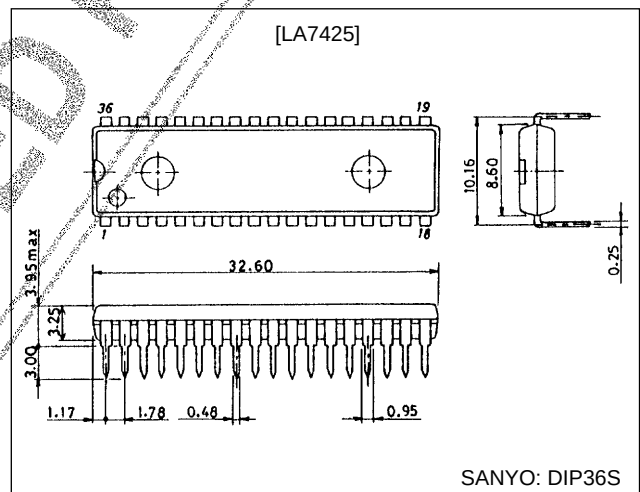
- Single CCD system

The LA7425 supports the following functions with the addition of only a single CCD (1H delay) device: comb filter, YNR, DOC and chroma crosstalk cancellation. Thus the cost of external components is lowered.

- Full HQ support (YNR, CNR, detail enhancer and WCL up)

Package Dimensions

unit: mm

3170-DIP36S

SANYO Electric Co., Ltd. Semiconductor Business Headquarters

TOKYO OFFICE Tokyo Bldg., 1-10, 1 Chome, Ueno, Taito-ku, TOKYO, 110-8534 JAPAN

51595TH (OT) No. 5110-1/7

Functions

All VHS format VCR (NTSC) signal processing functions

	Luminance		Chrominance	
R/P	Video amp. Feedback clamp Main LPF YNR VCA Sync separator 4.1 V regulator		3.58 BPF ACC amp. ACC det. Main converter 1.3 M LPF VXO/XO Side lock det. 3rd lock protector	Half H Killer BGP generator Killer det. VCO Phase shifter Sub converter 4.21 BPF
REC	Video AGC amp. Video AGC det. Pre LPF Y/C comb filter Detail enhancer 1/2 f_H carrier shift	NL emphasis Main emphasis White/dark clip FM modulator Sync det.	Pre amp. Burst emphasis Killer APC det. AFC det. Burst gate amp.	
PB	FM equalizer 629 chroma trap FM AGC amp. FM AGC det. S-VHS det. Double limiter FM demodulator Double high-pass noise canceller	QV/QH/character insert Sub LPF Main de-emphasis DOC Drop out det. NL de-emphasis Picture control Y/C mix	Pre amp. Burst de-emphasis PB amp. Killer CNR Carrier balancer Burst gate amp. Chroma noise canceller	APC det. ID det. PCC Trick det. DPLL

Specifications

Maximum Ratings at $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	$V_{CC\text{ max}}$		7.0	V
Allowable power dissipation	$P_{D\text{ max}}$	$T_a \leq 65^\circ\text{C}$	1070	mW
Operating temperature	T_{opr}		-10 to +65	$^\circ\text{C}$
Storage temperature	T_{stg}		-40 to +150	$^\circ\text{C}$

Operating Conditions at $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	V_{CC}		5.0	V
Operating supply voltage range	$V_{CC\text{ op}}$		4.8 to 5.5	V

Operating Characteristics at $T_a = 25^\circ\text{C}$, $V_{CC} = 5.0\text{ V}$

Parameter	Symbol	Conditions	min	typ	max	Unit
[Record Mode Y System]						
Record mode current drain	I_{CCR}	Input: 1.0 Vp-p video signal	95	120	145	mA
EE output level	V_{EE}	The T28 output level	2.04	2.15	2.26	Vp-p
AGC characteristics 1	AGC1	With the input level increased 6 dB	0	0.5	1.0	dB
AGC characteristics 2	AGC2	With the input level decreased 6 dB	-1.0	-0.3	0	dB
AGC characteristics 3	AGC3	Input: with only the sync level increased 6 dB, measure the T28 sync level.	540	600	660	mVp-p
AGC characteristics 4	AGC4	Input: with only the sync level decreased 6 dB, measure the T28 sync level.	370	410	450	mVp-p
Sync separator output level	V_{SYR}	The T26 output pulse peak value	4.0	4.4	4.6	Vp-p
Sync separator output pulse width	PW_{SYR}	The T26 output pulse width	4.1	4.4	4.7	μs
Sync separator output leading edge delay time	ΔT_{SYR}		0.8	1.0	1.2	μs
Sync separator threshold level	TH_{SYR}			-23	-19	dB
VCA detection voltage	V_{VCA}		3.00	3.20	3.40	V

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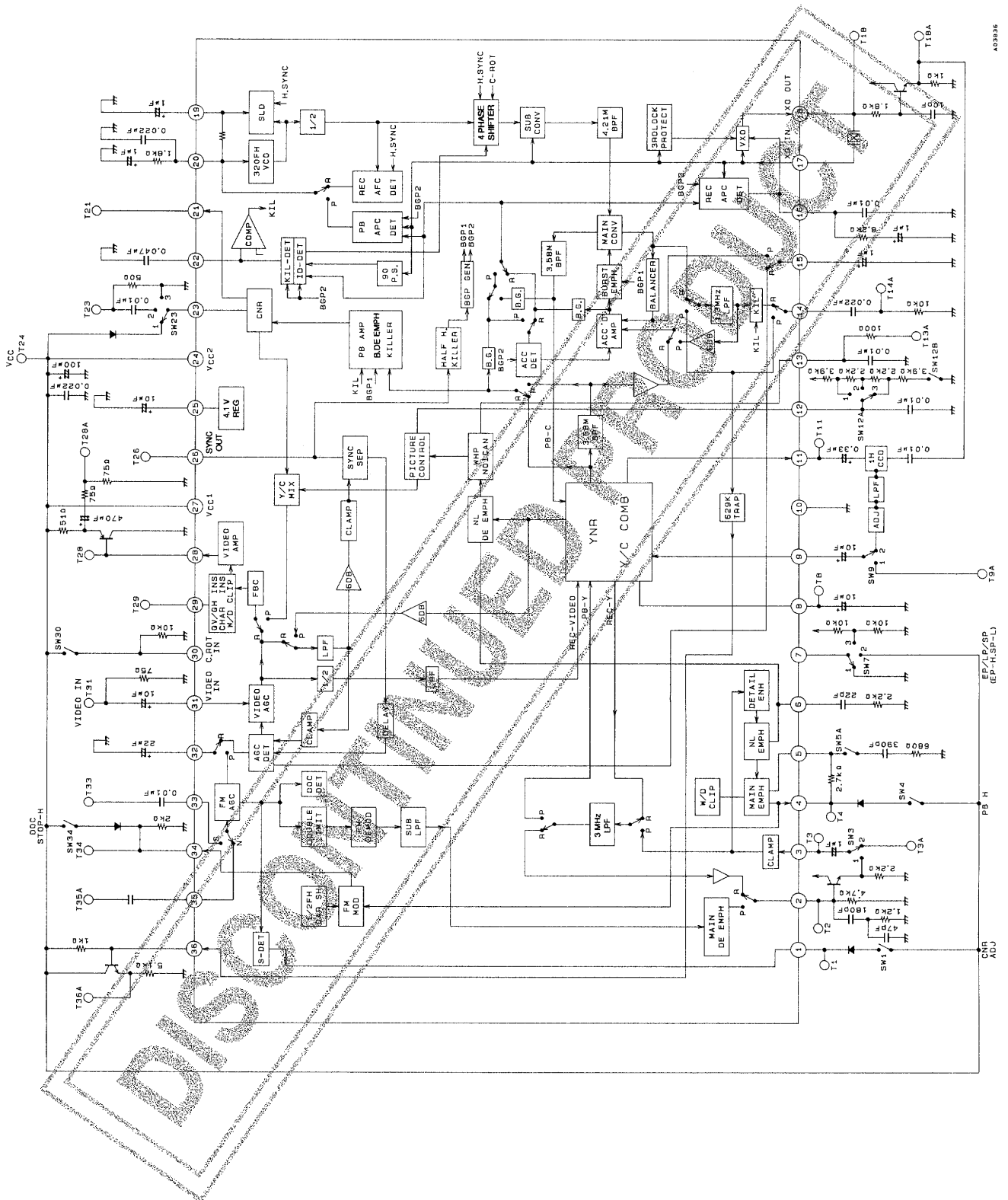
Parameter	Symbol	Conditions	min	typ	max	Unit
Y comb characteristics	G _{Y-COMB}	Input: chroma noise test signal 1 Vp-p, measure T2.			-25	dB
C comb characteristics	G _{C-COMB}	Input: white 50% plus CW 3 MHz, measure T21.			-25	dB
Record YNR operation EP/LP	R-YNR		10	12	14	mV
CCD front-end LPF frequency characteristics 1	PFIL1	The attenuation at 4 MHz referenced to 500 kHz	0	0.5	1.0	dB
CCD front-end LPF frequency characteristics 2	PFIL2	The attenuation at 10 MHz referenced to 500 kHz	-17	-15	-13	dB
Y LPF frequency characteristics 1	YLPF1	The attenuation at 1 MHz referenced to 500 kHz	-0.5	0	+0.5	dB
Y LPF frequency characteristics 2	YLPF2	The attenuation at 2 MHz referenced to 500 kHz	-0.5	+0.5	+1.5	dB
Y LPF frequency characteristics 3	YLPF3	The attenuation at 3 MHz referenced to 500 kHz	-8	-6	-4	dB
Y LPF frequency characteristics 4	YLPF4	The attenuation at 3.58 MHz referenced to 500 kHz			-15	dB
Y LPF frequency characteristics 5	YLPF5	The attenuation at 4.2 MHz referenced to 500 kHz			-15	dB
FM modulator output level	V _{FM}	With no input signal	0.96	1.08	1.21	mVp-p
FM modulator output second harmonic distortion	H _{MOD}			-40	-35	dB
Carrier frequency	F _{FM}		3.30	3.40	3.50	MHz
Deviation	FM _{DEV}		0.95	1.00	1.05	MHz
FM modulator linearity	L _{MOD}	T3 = 2.6 V, 2.85 V, 3.1 V	-2	0	+2	%
1/2 f _H carrier shift	CS		6.8	7.8	9.5	kHz
Emphasis gain	G _{EMPH}	Input: 0.5 Vp-p 10 kHz sine wave	-0.5	0	+0.5	dB
Detail enhancer characteristics 1	G _{ENH1}	Input: -10 dB, 2 MHz	1.6	1.9	2.6	dB
Detail enhancer characteristics 2	G _{ENH2}	Input: -20 dB, 2 MHz	3.1	4.1	5.1	dB
Detail enhancer characteristics 3	G _{ENH3}	Input: -30 dB, 2 MHz	5.3	6.3	7.3	dB
Detail enhancer characteristics 4	G _{ENH4}	Input: -30 dB, 2 MHz, edit mode	2.9	3.9	4.9	dB
NL emphasis characteristics 1	G _{NLEMP1}	Input: 500 mVp-p, 2 MHz	0.5	1.4	2.3	dB
NL emphasis characteristics 2	G _{NLEMP2}	Input: -10 dB, 2 MHz	2.6	3.8	5.2	dB
NL emphasis characteristics 3	G _{NLEMP3}	Input: -20 dB, 2 MHz	4.9	6.4	7.9	dB
Main emphasis characteristics 1	G _{ME1}	Input: -20 dB, 200 kHz	4.9	5.2	5.5	dB
Main emphasis characteristics 2	G _{ME2}	Input: -20 dB, 2 MHz	13.1	13.6	14.1	dB
White clipping level	L _{WC}	Input: 1.0 Vp-p white 100% video signal	180	190	200	%
Dark clipping level	L _{DC}	Input: 1.0 Vp-p white 100% video signal	-55	-50	-45	%
Synchronization detector output level	V _{SYDET}		2.7	3.0	3.3	V
[Playback Mode Y System]						
Playback mode current drain	I _{CCP}		120	150	180	mA
FM equalizer characteristics 1	G _{FM-EQ1}	Input: 300 mVp-p, 4 MHz	-1.0	+1.0	+3.0	dB
FM equalizer characteristics 2	G _{FM-EQ2}	Input: 300 mVp-p, 629 kHz			-30	dB
Dropout compensation period	T _{DOC}		8	10	12	H
DOC loop gain	G _{DOC}	5H later	-1.0	0	+1.0	dB
Playback Y level	V _{Y-OUT}		2.04	2.15	2.26	Vp-p
FM demodulator linearity	L _{DEM}	2, 4, 6 MHz	-3.5	0	+3.5	%
Demodulator carrier leakage	CL	Input: 4 MHz, 300 mVp-p		-40	-35	dB
Playback YNR characteristics 1 (LP/EP)	P-YNR1	Input: white 50% plus CW	-9	-8	-7	dB
Playback YNR characteristics 2 (SP)	P-YNR2	Input: white 50% plus CW	-4.5	-3.5	-2.5	dB
NL de-emphasis characteristics 1	G _{NLDEEM1}	Input: -10 dB, 2 MHz	-6.0	-5.0	-4.0	dB
NL de-emphasis characteristics 2	G _{NLDEEM2}	Input: -20 dB, 2 MHz	-9.0	-8.0	-7.0	dB
Noise canceller characteristics 1	G _{WNC1}	Input: -10 dB, 1.2 MHz	-2.7	-2.2	-1.7	dB
Noise canceller characteristics 2	G _{WNC2}	Input: -20 dB, 1.2 MHz	-7	-6	-5	dB
Noise canceller characteristics 3	G _{WNC3}	Input: -30 dB, 1.2 MHz	-13	-11	-9	dB

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Parameter	Symbol	Conditions	min	typ	max	Unit
Picture control hard response characteristics 1	G_{PH1}	Input: -10 dB, 1 MHz	1.0	1.5	2.0	dB
Picture control hard response characteristics 2	G_{PH2}	Input: -10 dB, 2 MHz	3.2	4.2	5.2	dB
Picture control soft response characteristics 1	G_{PS1}	Input: -10 dB, 1 MHz	-6.0	-5.0	-4.0	dB
Picture control soft response characteristics 2	G_{PS2}	Input: -10 dB, 2 MHz	-12.0	-10.0	-8.0	dB
Quasi-V insertion level (playback)	ΔV_{DP}	$V_{29} = 5 \text{ V}$	-80	0	+80	mV
Quasi-H insertion level (playback)	ΔH_{DP}	$V_{29} = 2.5 \text{ V}$	-200	-100	0	mV
Sync separator output level	V_{SYP}	Pin 26 output pulse peak value	4.0	4.4	4.6	Vp-p
Sync separator output pulse width	PW_{SYP}	Pin 26 output pulse width	4.3	4.6	4.9	μs
Sync separator output leading edge delay time	ΔT_{SYP}		1.25	1.45	1.65	μs
Built-in regulator voltage	V_{REG}		3.9	4.1	4.3	V
S-VHS discriminator output level	V_{SVHSP}		2.7	3.0	3.3	V
[Record Mode Chroma System]						
Y/C separator output burst level	V_{OR-21}	Pin 21 burst level	120	150	180	mVp-p
Chroma low frequency conversion burst level	V_{OR-14}	Input: standard color bar signal 1 Vp-p	322	380	438	mVp-p
Burst emphasis	G_{BE}		5.5	6.0	6.5	dB
VXO oscillator level	V_{VXO-R}	Input: standard color bar signal 1 Vp-p	400	500	600	dB
ACC characteristics 1	ACC_{R1}	With only the color signal level increased 6 dB		+0.2	+0.5	dB
ACC characteristics 2	ACC_{R2}	With only the color signal level decreased 6 dB	-0.5	-0.1		dB
ACC killer on input level	$V_{IN-ACCK-ON}$		-29	-26	-23	dB
ACC killer on output level	V_{O-ACCK}			-60	-50	dB
ACC killer recovery input level	$V_{IN-ACCK-OFF}$		-23	-20	-17	dB
APC pull-in range 1	Δf_{APC1}		+350	+480		Hz
APC pull-in range 2	Δf_{APC2}			-770	-350	Hz
AFC pull-in range 1	Δf_{AFC1}		+1.0	+3.0		kHz
AFC pull-in range 2	Δf_{AFC2}			-2.5	-1.0	kHz
Record Y/C level ratio	C/FM		-9.9	-9.1	-8.3	dB
[Playback Mode Chroma System]						
Video output burst level	V_{OP-28}	SP mode, input burst 160 mVp-p	235	277	319	mVp-p
Pin 21 output burst level	V_{OP-21}	SP mode, input burst 160 mVp-p	149	175	201	mVp-p
ACC characteristics 1	ACC_{P1}	With the input chroma level increased 6 dB		0.5	0.8	dB
ACC characteristics 2	ACC_{P2}	With the input chroma level decreased 6 dB	-0.5	-0.2		dB
Killer on input level	V_{ACK-P}		-55		-40	dB
Killer on chroma output level	V_{OACKP}			-44	-40	dB
Main converter carrier leakage	C_{LP}	The 4.21 MHz carrier leakage component		-40	-33	dB
4.84 MHz spurious signal level	SPR_{484}				-35	dB
Burst de-emphasis	G_{BP}		-5.35	-5.10	-4.85	dB
XO output level	V_{XO-P}		370	470	570	mVp-p
XO oscillator frequency deviation	Δf_{XO}	$\Delta f_{XO} = f - 3579545 \text{ (Hz)}$	-7	0	+7	Hz

Test Circuit



Control Pin Function Table

Pin No.	Control function		L	M	H
1	CNR adjustment Forced NVHS control	REC	Synchronization detector output when open. (0 V when synchronized, 3.0 V when not synchronized)		3.6 V or higher CNR adjustment mode
		PB	S-VHS detector output when open. (0 V in normal mode, 3.0 V for S-VHS)		3.6 V or higher Forced N-VHS mode
4	Record/playback switching		Open Record mode		3.8 V or higher Playback mode
7	SP/LP/EP switching		1.2 V or lower SP mode	1.8 to 2.7 V LP mode	3.3 V or higher EP mode
11			If a 3.3 kΩ resistor is connected between pin 11 and ground, the playback mode SP YNR will be set to strong (K = 0.5), and to very strong (K = 0.6) in LP/EP modes.		
12	Edit/picture control		2 to 2.5 V Picture control: soft	2.5 to 3 V Picture control: hard	3.6 V or higher Edit mode
13	Noise canceller control Y/C mix off		1.5 V or lower Noise canceller: off	2.0 to 3.0 V Noise canceller linear control	3.8 V or higher Y/C mix: off (playback Y/C separate output)
16	APC loop switching (trick mode)				3.8 V or higher (200 μA or higher) APC loop "post-comb"
21					3.5 V or higher Record: XO: forced free-run
23	CNR control		1.5 V or lower ***	Open CNR: on	2.5 V or higher CNR: off
29	QV/QH insertion		0.8 V or lower Through	1.0 to 2.2 V Character insertion	2.5 to 3.2 V QH insertion
30	Rotary pulse input		1.2 V or lower Low CH		3.8 V or higher QV insertion
34	DOC stop control		Open Normal mode	1.8 V or higher High CH	3.75 V or higher DOC stopped

Note: Do not set pin 12 to a voltage of 1.5 V or lower, since the chip will enter test mode.

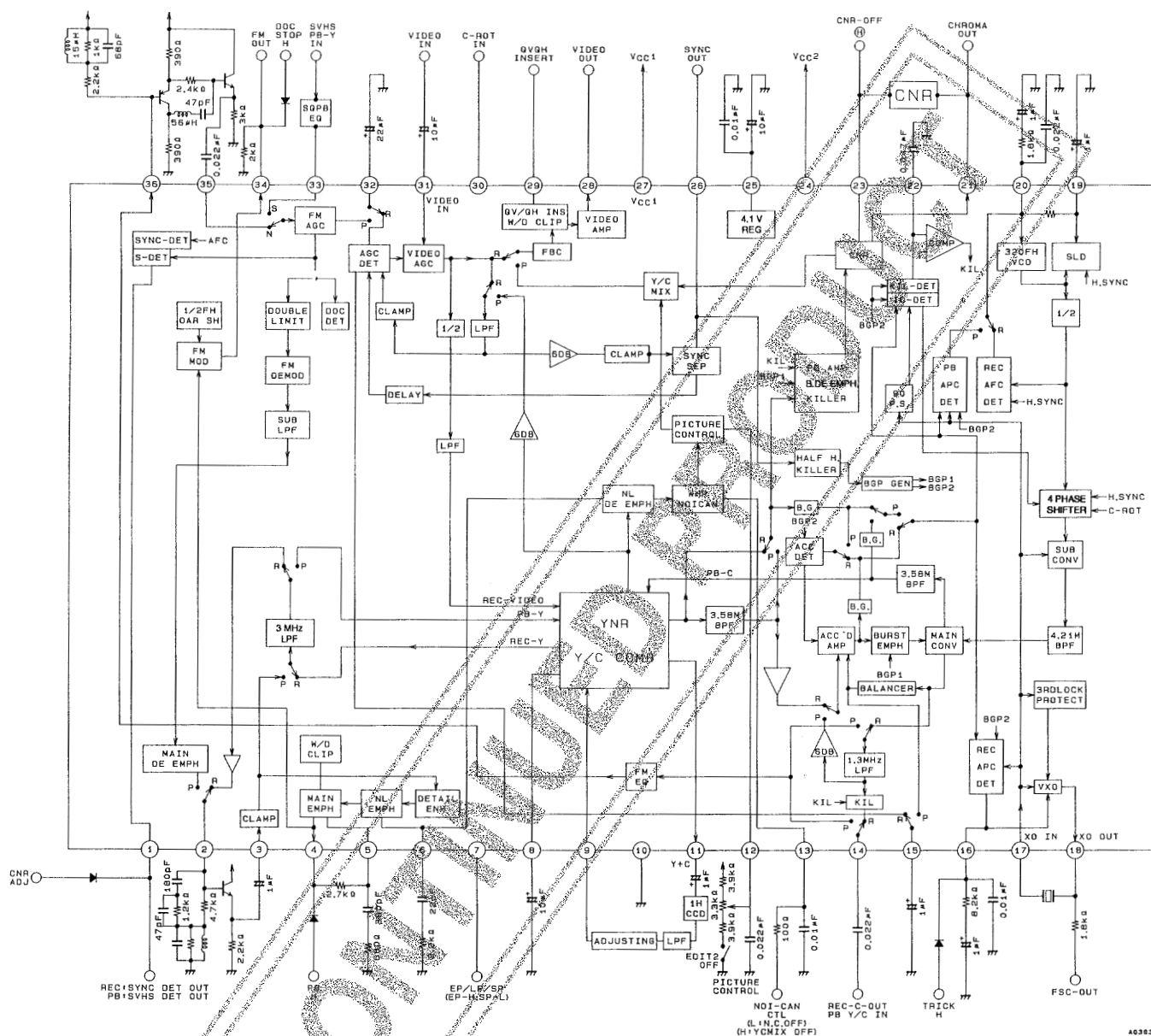
Mode Control Table

			SP		EP		LP	
			Normal	Edit	Normal	Edit	Normal	Edit
REC	Detail enhancer		Strong	Weak	Weak	Weak	Weak	Weak
	YNR	K	0.65					
		LIMITT	5 IRE					
	Y/C comb separator	C	O	—	O	—	O	—
		Y	O					
	1/2 f _H carrier shift		—			O		
	Nonlinear emphasis		—			O		
Burst emphasis		O			—			
PB	YNR	K	0.2		0.5	0.2	0.5	0.2
		LIMITT	5 IRE		11 IRE	5 IRE	11 IRE	5 IRE
	Picture control		O	Center point	O	Center point	O	Center point
	Burst de-emphasis		O			—		
	Crosstalk cancellation correlation switching		O			—		
	APC loop		Pre-comb*			Post-comb		
	Four phase shift clock		DPLL output				HHK output	

Note: CNR is not turned off in edit mode.

* The APC loop becomes post-comb when pin 16 is set high (trick mode).

Block Diagram



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