

SANYO**LA70020, 70020M****Recording/Playback Amplifier for VHS VCRs****Overview**

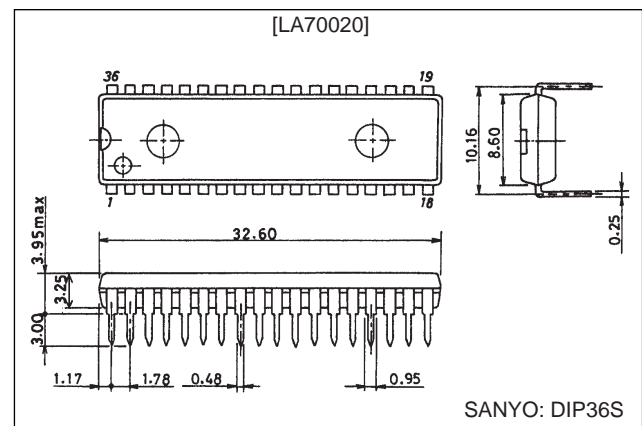
The LA70020 and LA70020M are 6-head amplifiers adding hi-fi recording/playback amplifiers to the LA70011/LA70011M recording/playback amplifiers for VHS VCR video signals. When used in combination with the LA71000M and LA71500M Series of video signal processing ICs, they permit Y/C recording without current adjustment.

Features

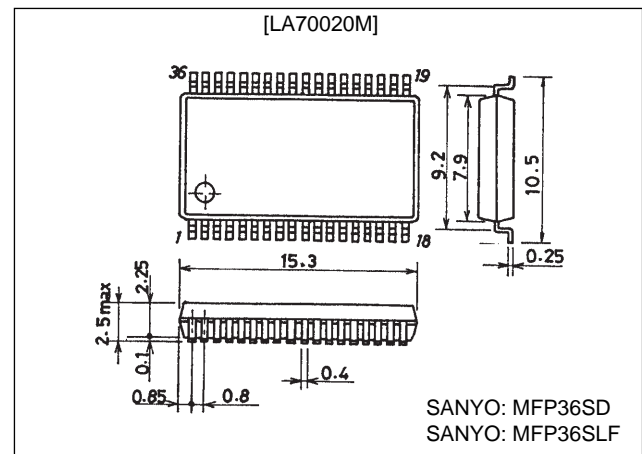
- Combining hi-fi and video amplifiers onto a single chip saves space on the circuit board.
- Connecting the playback amplifier input directly to the head reduces the number of external elements required.
- The recording amplifiers use a fixed-current drive configuration that yields stable recording characteristics even under changing loads. They include built-in automatic gain control circuits.
- The LA70020, encapsulated in DIP package, can be mounted at the right end of the LA70001 and LA70011 sockets. The LA70020M lacks this flexibility because its MFP package has a different pin pitch.

Package Dimensions

unit: mm

3170-DIP36S 400mil

unit: mm

3129-MFP36SD, MFP36SLF**Specifications****Maximum Ratings at Ta = 25°C**

Parameter	Symbol	Conditions	Ratings	Unit
Maximum power supply voltage	$V_{CC \max}$		6.0	V
Maximum power dissipation	$P_d \max$	$T_a \leq 65^\circ\text{C}$ [LA70020]	1000	mW
		$T_a \leq 65^\circ\text{C}$ [LA70020M]	1000	mW
		114.3 × 76.1 × 1.6 mm: glass epoxy		
Operating temperature	T_{opr}		-10 to +65	°C
Storage temperature	T_{stg}		-40 to +150	°C

Operating Conditions at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	V_{CC}		5.0	V
Operating supply voltage range	V_{CCop}		4.8 to 5.3	V

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Electrical Characteristics at Ta = 25°C (Video Circuits)

Parameter		Symbol	Conditions	Ratings			Unit
				min	typ	max	
Playback Mode							
Current drain		I _{CCP}	Current flowing into pin 13	44	53	60	mA
Voltage gain	SP-L CH1	G _{VP1}	V _{IN} = 38 mVp-p, f = 4 MHz	56	59	62	dB
	SP-H CH2	G _{VP2}		56	59	62	dB
	EP-L CH3	G _{VP3}		56	59	62	dB
	EP-H CH4	G _{VP4}		56	59	62	dB
Voltage gain difference		ΔG _{VP1}	G _{VP1} — G _{VP2}	−1	0	+1	dB
		ΔG _{VP2}	G _{VP3} — G _{VP4}	−1	0	+1	dB
Intermode gain difference		ΔG _{VP3}	G _{VP3} — G _{VP1}	−1	0	+1	dB
Converted input noise voltage	CH1 CH2 CH3 CH4	V _{NIN1} V _{NIN2} V _{NIN3} V _{NIN4}	Ratio of the output from a 1.1 MHz low pass filter to the output with no input under the same conditions as those used for measuring voltage gain.		1.0	1.5	μVrms
Frequency characteristic	CH1 CH2 CH3 CH4	ΔV _{fp1} ΔV _{fp2} ΔV _{fp3} ΔV _{fp4}	Ratios of the output for V _{IN} = 38 mVp-p and f = 7 MHz to the voltage gains G _{VP1} , G _{VP2} , G _{VP3} , and G _{VP4} .	−2.5	0		dB
Secondary harmonic distortion	CH1 CH2 CH3 CH4	ΔV _{HDP1} ΔV _{HDP2} ΔV _{HDP3} ΔV _{HDP4}	Ratio of the 8 MHz (secondary) component of the output to its 4 MHz (primary) component for V _{IN} = 38 mVp-p and f = 4 MHz.		−40	−35	dB
Maximum output level	CH1 CH2 CH3 CH4	ΔV _{OMP1} ΔV _{OMP2} ΔV _{OMP3} ΔV _{OMP4}	Output level, for f = 1 MHz, at which the ratio of the 3 MHz (tertiary) component to the 1 MHz (primary) component is -30 dB.	1.0	1.2		Vp-p
Crosstalk SP		V _{CR1}	Ratio of the output for V _{IN} = 38 mVp-p and f = 4 MHz to G _{VP1} .		−40	−35	dB
		V _{CR2}	Ratio of the output for V _{IN} = 38 mVp-p and f = 4 MHz to G _{VP2} .		−40	−35	dB
Crosstalk EP		V _{CR3}	Ratio of the output for V _{IN} = 38 mVp-p and f = 4 MHz to G _{VP3} .		−40	−35	dB
		V _{CR4}	Ratio of the output for V _{IN} = 38 mVp-p and f = 4 MHz to G _{VP4} .		−40	−35	dB
Output DC offset		ΔV _{ODC1}	CH1 — CH2	−100	0	+100	mV
		ΔV _{ODC2}	CH3 — CH4				
		ΔV _{ODC3}	CH1 — CH3				
		ΔV _{ODC4}	CH2 — CH4				
		ΔV _{ODC5}	CH1 — CH4				
		ΔV _{ODC6}	CH2 — CH3				
Envelope detector output pin voltage		V _{ENV}	T12 DC level with no signal input.	0	0.8	1.4	V
Envelope detector output pin voltage SP		V _{ENVSP1}	T12 DC level at which T13A output level is 150 mVp-p for f = 4 MHz.	2.0	2.5	3.0	V
		V _{ENVSP2}	T12 DC level at which T13A output level is 400 mVp-p for f = 4 MHz.	4.0	4.5	5.0	V
Envelope detector output pin voltage EP		V _{ENVEP1}	T12 DC level at which T13A output level is 125 mVp-p for f = 4 MHz.	2.0	2.5	3.0	V
		V _{ENVEP2}	T6 DC level at which T7A output level is 300 mVp-p for f = 4 MHz.	4.0	4.5	5.0	V
Comparator output voltage		V _{COMP1}	T8 DC level for V _{IN} = 38 mVp-p and f = 4 MHz.		0.4	0.7	V
		V _{COMP2}	T8 DC level for V _{IN} = 38 mVp-p and f = 4 MHz.	4.5	4.8		V
SW-Tr on resistance during playback		R _{PON24} R _{PON29}	DC difference for 1 and 2 mA current inputs.		4	6	Ω
Trick threshold level		TR1-1	Normal → Trick1 : *1	3.2		5.0	V
		TR1-2	Trick1 → Normal	1.2		2.8	V
		TR2-1	Normal → Trick2 : *1	0.0		0.8	V
		TR2-2	Trick2 → Normal	1.2		2.8	V

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Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
HA playback threshold level	HAP-1	SP → EP : *1	1.7		5.0	V
	HAP-2	EPSP	0.0		1.3	V
SW30 threshold level	SW30-1	Lch → Hch : *1	1.2		5.0	V
	SW30-2	Hch → Lch	0.0		0.8	V
Recording Mode						
Current drain	I _{CCR}	Current input at pin 13.	52	59	66	mA
REC AGC AMP output level	V _{RSP}	Output level for V _{IN} = 400 mVp-p and f = 4 MHz.	127	135	143	mVp-p
	V _{REP}		104	111	119	mVp-p
Intermode gain difference	ΔGVR	VRSP/VREP	1.4	1.7	2.0	dB
REC AGC AMP control characteristic	ΔV _{AGC1} -SP ΔV _{AGC1} -EP	Output level divided by V _{RSP} or V _{REP} for f = 4 MHz and V _{IN} = 700 mVp-p.		0.5	1.0	dB
	ΔV _{AGC2} -SP ΔV _{AGC2} -EP	Output level divided by V _{RSP} or V _{REP} for f = 4 MHz and V _{IN} = 100 mVp-p.	-1.0	-0.5		dB
REC AGC AMP frequency characteristic	ΔV _{FRS} ΔV _{FRE}	Ratio of f = 7 MHz output to f = 1 MHz output for V _{IN} = 400 mVp-p. *2	-1	0	+1	dB
REC AGC AMP secondary primary distortion	ΔV _{HDRS} ΔV _{HDRE}	Ratio of the 8 MHz (secondary) component of the output to its 4-MHz (primary) component for V _{IN} = 400 mVp-p and f = 4 MHz.		-45	-40	dB
REC AGC AMP maximum output level	ΔV _{MOSP} ΔV _{MOEP}	Output level, for f = 4 MHz, at which the secondary distortion is -35 dB.	20	22		mApp
REC AGC AMP muting attenuation	ΔV _{MRS} ΔV _{MRE}	Output level divided by V _{RSP} or V _{REP} for f = 4 MHz and V _{IN} = 400 mVp-p.		-45	-40	dB
REC AGC AMP cross modulation relative level	ΔV _{CYS} ΔV _{CYE}	Output ratio (4M +/- 629k)/4M for V _{IN} = 400 mVp-p and f = 4 MHz at T9A and V _{IN} = 2.4 Vp-p and f = 629 kHz at T10A.		-45	-40	dB
HA REC threshold level	HAR-1	SP → EP : *1	1.7		5.0	V
	HAR-2	EP → SP	0.0		1.3	V
REC MUTE threshold level	MUTE-1	MUTE OFF → MUTE ON *1	1.2		2.8	V
	MUTE-2	MUTE ON → MUTE OFF	3.2		5.0	V
REC PB threshold level	PB-REC	PB → REC *1	1.2		5.0	V
	REC-PB	REC → PB	0.0		0.8	V

Notes: * Before measuring the items under Playback Mode, input a 0 to 5.0 V trigger pulse to T11 (H-SYNC), the pin from which the LA70020 takes its T9 (HA) control switch timing.

* The resistance between pins 19 and 20 must be accurate to within 1.0%.

*1. These are voltage application points.

*2. Apply a DC voltage of approximately 1.8 V to the AGC wave detector filter pin (pin 21) to fix the AGC amplifier gain.

*3. Apply a DC voltage to the REC-CUR-Adj pin (pin 18) and adjust the output level.

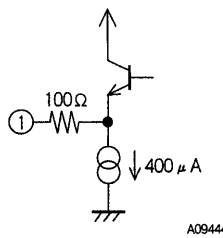
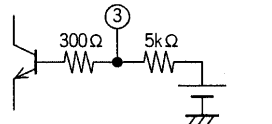
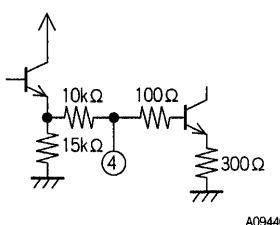
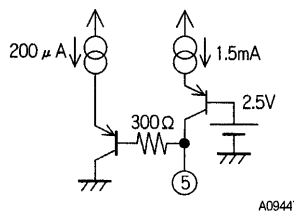
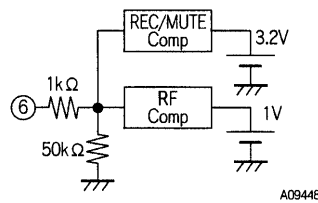
LA70020, 70020M

Electrical Characteristics at Ta = 25°C (Hi-Fi Circuits)

Parameter		Symbol	Conditions	Ratings			Unit
				min	typ	max	
Playback Mode							
Current drain		H _{ICCP}	Current flowing into pin 36	20	25	30	mA
Voltage gain	CH1	HG _{VP1}	V _{IN} = 20 mVp-p, f = 1.5 MHz	72.5	75.5	78.5	dB
	CH2	HG _{VP2}		72.5	75.5	78.5	dB
Voltage gain difference		ΔHG _{VP}	HG _{VP1} — HG _{VP2}	−2	0	+2	dB
Intermode gain difference		ΔHGEP	Voltage gain difference between SP and EP modes. *1	1.7	2.4	3.1	dB
Converted input noise voltage	CH1	HV _{NIN1}	Ratio of the output from a 1.1-MHz low pass filter to the output with no input under the same conditions as those used for measuring voltage gain.		0.8	1.2	μVrms
	CH2	HV _{NIN2}					
Frequency characteristic	CH1 CH2	ΔHV _{fp1} ΔHV _{fp2}	Ratios of the output for V _{IN} = 20 mVp-p and f = 2 MHz to the voltage gains HG _{VP1} and HG _{VP2} .	−3	−1		dB
Secondary harmonic distortion	CH1 CH2	ΔHV _{HDP1} ΔHV _{HDP2}	Ratio of the 3-MHz (secondary) component of the output to its 1.5-MHz (primary) component for V _{IN} = 20 mVp-p and f = 1.5 MHz.		−50	−40	dB
Maximum output level	CH1 CH2	ΔHV _{OMP1} ΔHV _{OMP2}	Output level, for f = 1.5 MHz, at which the ratio of the 4.5 MHz (secondary) component to the 1.5 MHz (primary) component is −30 dB	2			Vp-p
Crosstalk SP		V _{HCR1}	Ratio of the output for V _{IN} = 20 mVp-p and f = 1.5 MHz to HG _{VP1} .		−40	−35	dB
		V _{HCR2}	Ratio of the output for V _{IN} = 20 mVp-p and f = 1.5 MHz to HG _{VP2} .		−40	−35	dB
Crosstalk EP		V _{HCR3}	Ratio of the output for V _{IN} = 20 mVp-p and f = 1.5 MHz to HG _{VP1} .		−40	−35	dB
		V _{HCR4}	Ratio of the output for V _{IN} = 20 mVp-p and f = 1.5 MHz to HG _{VP2} .		−40	−35	dB
Output DC offset SP mode		ΔV _{ODC1}	CH1 — CH2	−30	0	+30	mV
Output DC offset EP mode		ΔV _{ODC2}	CH1 — CH2	−50	0	+50	mV
HA threshold level		H _{HAP-1}	SP → EP : *1	1.7		5.0	V
		H _{HAP-2}	EP → SP	0.0		1.3	V
SW30 threshold level		H _{SW30-1}	Lch → Hch : *1	1.2		5.0	V
		H _{SW30-2}	Hch → Lch	0.0		0.8	V
SW-Tr on resistance during playback		H _{RPN}	DC difference for 1 and 2 mA current inputs.		4	6	Ω
Recording Mode							
Current drain		H _{ICCR}	Current input at pin 36.	55	65	75	mA
REC AGC AMP output level		H _{VOR}	Output level for V _{IN} = 180 mVp-p and f = 1.5 MHz.	270	280	290	mVp-p
REC AGC AMP control characteristic		ΔHV _{AGC1}	Output level divided by HV _{OR} for f = 1.5 MHz and V _{IN} = 360 mVp-p.		0.2	0.5	dB
		ΔV _{AGC2}	Output level divided by HV _{OR} for f = 1.5 MHz and V _{IN} = 90 mVp-p.	−0.5	−0.2		dB
REC AGC AMP muting attenuation		ΔHV _{MR}	Output level divided by HV _{OR} for f = 4 MHz and V _{IN} = 180 mVp-p.			−40	dB
REC AGC AMP cross modulation relative level for 0.4-MHz component		HCMD04	0.4-MHz component for T3A V _{IN} = 90 mVp-p, f = 1.3 MHz + V _{IN} = 270 mVp-p, f = 1.7 MHz.			−40	dB
REC AGC AMP cross modulation relative level for 0.9-MHz component		HCMD09	0.9-MHz component for T3A V _{IN} = 90 mVp-p, f = 1.3 MHz + V _{IN} = 270 mVp-p, f = 1.7 MHz.			−40	dB
REC MUTE threshold level		H _{MUTE1}	MUTE OFF → MUTE ON *1	1.2		2.8	V
		H _{MUTE2}	MUTE ON → MUTE OFF	3.2		5.0	V
REC PB threshold level		PB-REC	PB → REC *1	1.2		5.0	V
		REC-PB	REC → PB	0.0		0.8	V

Note : These are voltage application points.

Pin Descriptions

Pin Number	Pin Name	Standard DC Voltage (V)		Equivalent Circuit	Notes						
1	HiFi PB-FM-OUT	PB	2.6	 A09444							
		REC	4.0								
2 31	HiFi GND										
3	HiFi REC-FM-IN	PB	0	 A09445							
		REC	3.0								
4	HiFi REC-AGC-Filt	PB	0	 A09446							
		REC	1.2								
5	HiFi REC-CURRENT- ADJ	PB	0.7	 A09447							
		REC	1.5								
6	HiFi RF-SW (REC-MUTE)			 A09448	<div>SW30 MUTE</div> <table><tr><td rowspan="2">1.0</td><td>Hch</td><td>ON</td><td rowspan="2">3.2 V</td></tr><tr><td>Lch</td><td>OFF</td></tr></table>	1.0	Hch	ON	3.2 V	Lch	OFF
1.0	Hch	ON	3.2 V								
	Lch	OFF									

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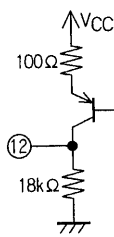
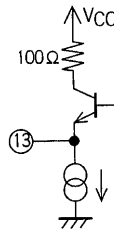
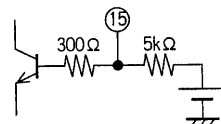
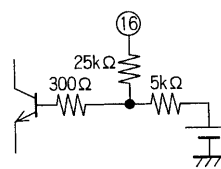
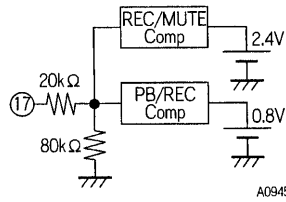
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Pin Number	Pin Name	Standard DC Voltage (V)		Equivalent Circuit	Notes						
7	TRICK-H			<p>A09449</p>	<table><tr><td>Trick1</td><td>3.0 V</td></tr><tr><td>NORMAL</td><td></td></tr><tr><td>Trick2</td><td>1.0 V</td></tr></table>	Trick1	3.0 V	NORMAL		Trick2	1.0 V
Trick1	3.0 V										
NORMAL											
Trick2	1.0 V										
8	COMP-OUT	PB H: min. 4.5 V L: max. 0.7 V	REC Open	<p>A09450</p>	EP > SP ENV High						
9	HA (EP/SP)			<p>A09451</p>	<table><tr><td>EP</td><td>1.0 V</td></tr><tr><td>SP</td><td></td></tr></table>	EP	1.0 V	SP			
EP	1.0 V										
SP											
10	SW30			<p>A09452</p>	<table><tr><td>Hch</td><td>1.0 V</td></tr><tr><td>Lch</td><td></td></tr></table>	Hch	1.0 V	Lch			
Hch	1.0 V										
Lch											
11	H-SYNC			<p>A09453</p>	<table><tr><td>SYNC H</td><td>1.5 V</td></tr><tr><td>L</td><td></td></tr></table>	SYNC H	1.5 V	L			
SYNC H	1.5 V										
L											

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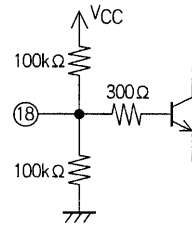
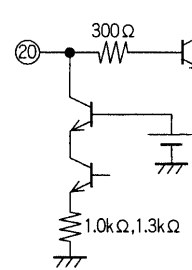
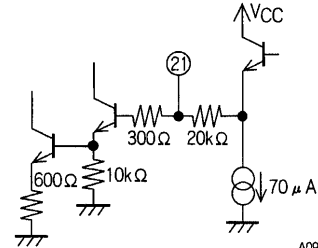
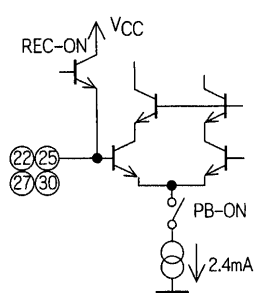
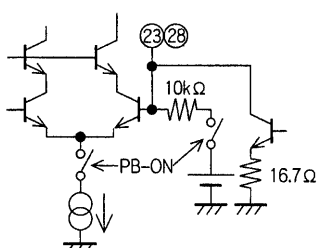
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Pin Number	Pin Name	Standard DC Voltage (V)		Equivalent Circuit	Notes					
12	ENVDET-OUT	PB	See relevant documents.	 A09454						
		REC	0							
13	PB-OUT	PB	1.7	 A09455						
		REC	0							
14 26	GND									
15	REC-Y-IN	PB	0	 A09456						
		REC	3.7							
16	REC-C-IN	PB	0	 A09457						
		REC	3.7							
17	REC/MUTE/PB			 A09458	<table><tr><td>REC</td><td rowspan="2">3.0 V</td></tr><tr><td>REC MUTE</td></tr><tr><td>PB</td><td>1.0 V</td></tr></table>	REC	3.0 V	REC MUTE	PB	1.0 V
REC	3.0 V									
REC MUTE										
PB	1.0 V									

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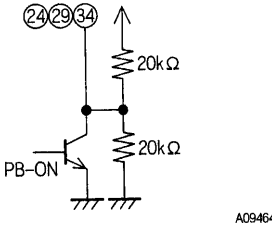
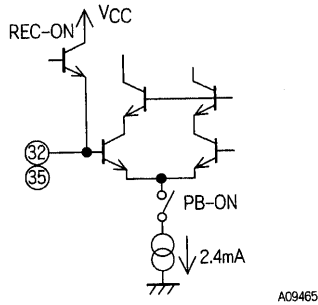
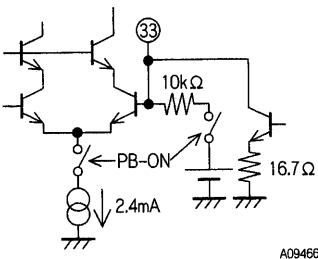
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Pin Number	Pin Name	Standard DC Voltage (V)		Equivalent Circuit	Notes
18	REC-CURRENT-ADJ2	PB	2.5 V	 <p>A09459</p>	
		REC	2.5 V		
19	VCC				
20	REC-CURRENT-ADJ1	PB	5.0	 <p>A09460</p>	
		REC	4.5		
21	REC-AGC-FILT	PB	0	 <p>A09461</p>	
		REC	1.6		
22 25 27 30	SP L-IN SP H-IN EP L-IN EP H-IN	PB	2.1	 <p>A09462</p>	
		REC	4.1		
23 28	REC SP OUT EP OUT	PB	2.1	 <p>A09463</p>	
		REC	4.1		

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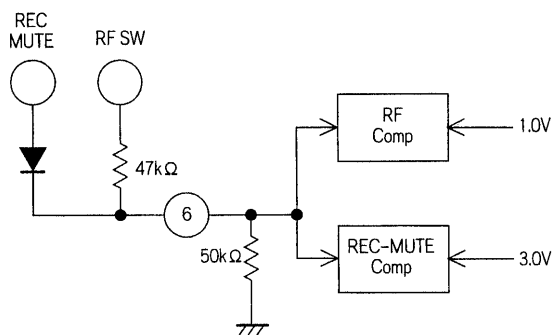
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Pin Number	Pin Name	Standard DC Voltage (V)		Equivalent Circuit	Notes
24 29 34	PB FILT	PB	0		
		REC	2.5		
32 35	HiFi PB-Lch-IN PB-Hch-IN	PB	2.1		
		REC	4.1		
33	HiFi REC-OUT	PB	2.1		
		REC	4.1		
36	HiFi V _{CC}	5.0			

Usage Notes

Control Pin Logic

HiFi RF-SW, REC-MUTE : Pin 6



During playback

Pin 6 level - DC < 1.0 V: Lch

Pin 6 level - DC > 1.0 V: Hch

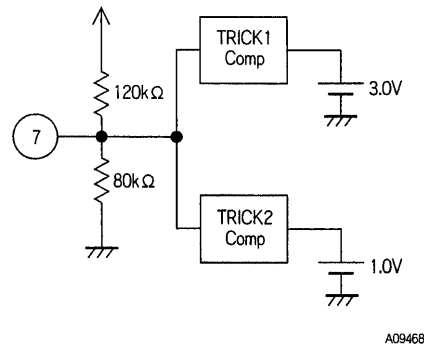
During recording

Pin 6 level - DC < 3.0 V: Mute off

Pin 6 level - DC > 3.0 V: Mute on

A09467

Switching Video Trick Mode with Pin 7



GND < pin 7 level - DC < 1.0 V: TRICK2
 1.0 V < pin 7 level - DC < 3.0 V: NORMAL
 3.0 V < pin 7 level - DC < 5.0 V: TRICK2

NORMAL Mode

Two channels selected with pin 9 (EP/SP): ON

Envelope comparator: OFF

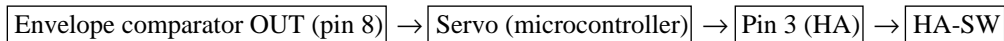
TRICK Modes

All four channels: ON

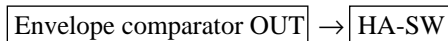
Envelope comparator: OFF

Difference between TRICK1 and TRICK2 modes

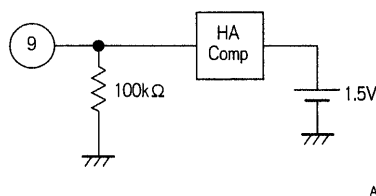
TRICK1 is a special playback mode using the following path



TRICK2 provides SP searching



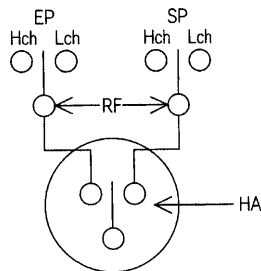
HA-SW (EP/SP mode switch): Pin 9



GND < pin 9 level - DC < 1.5 V: SP mode
 1.5 V < pin 9 level - DC < 5 V: EP mode

Video Synchronization of HA Switching Timing during Playback with H-SYNC Signal

During playback, the LA70020's video circuits synchronize the HA-SW switching timing shown in the following figure with the H-SYNC signal from pin 11. (Other EP/SP switching takes place in real time.)



The hi-fi playback amplifier's gain is approximately 2.4 dB higher in EP mode than in SP mode.

SP: 75.0 dB

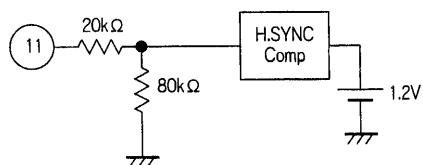
EP: 77.4 dB

Comparator Output: Pin 8

EP envelope > SP envelope: High (min. 4.0 V)

EP envelope < SP envelope: Low (max. 0.7 V)

H-SYNC Input: Pin 11



Pin 11 level - DC > 1.5 V: H-SYNC interval

A09471

Video circuit operation only

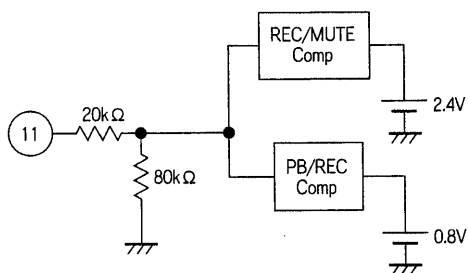
Playback:

- Determines timing of HA switching (EP/SP)
- Determines timing of special playback

Recording:

- Serves as gate pulse for REC-AGC-AMP SYNC unit

REC/REC-MUTE/PB Switching: Pin 17

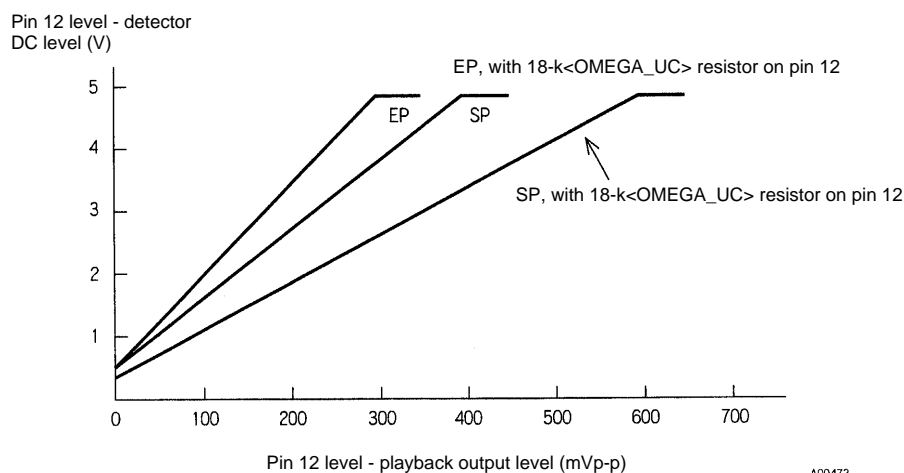


A09472

Envelope Detector Characteristic: Pin 12

The LA70020 includes a built-in playback signal envelope detector circuit for use in automating tracking adjustment.

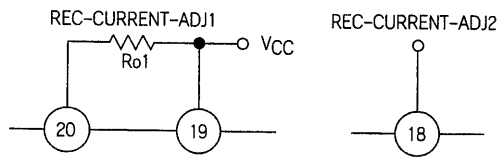
Envelope detector voltage characteristic



A09473

Video REC AMP Gain Control

The LA70020 eliminates recording current adjustment by adding an automatic gain control circuit to the recording amplifier. It is also possible to change the recording current with the following methods.



A09474

REC-CURRENT-ADJ2 Open

The internal bias forces the DC level at pin 18 to $1/2 V_{CC}$ (that is, approximately 2.5 V), and R_{O1} determines the recording current.

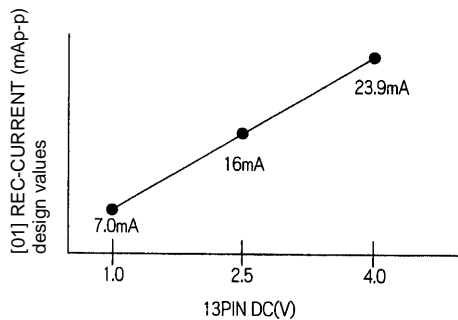
Design values

$R_{O1} = 1.5 \text{ k}\Omega = 16.0 \text{ mA (SP) (per channel)}$

$R_{O1} = 1.5 \text{ k}\Omega = 12.7 \text{ mA (EP)}$

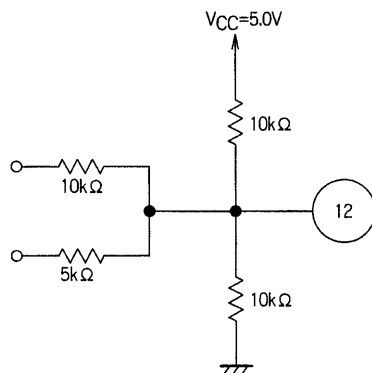
REC-CURRENT-ADJ2 Used

Applying a DC control voltage between 1 and 4 V to pin 18 adjusts the figure determined by R_{O1} between -6.0 dB and +3.5 dB.



A09475

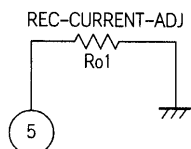
Note: One possible circuit for applying this voltage is the following, which provides 9 modes between 1 and 4 V.



A09476

Hi-Fi REC AMP Gain Control

The LA70020 eliminates recording current adjustment by adding an automatic gain control circuit to the recording amplifier. It is also possible to change the recording current with the following methods.



A09477

REC-CURRENT-ADJ

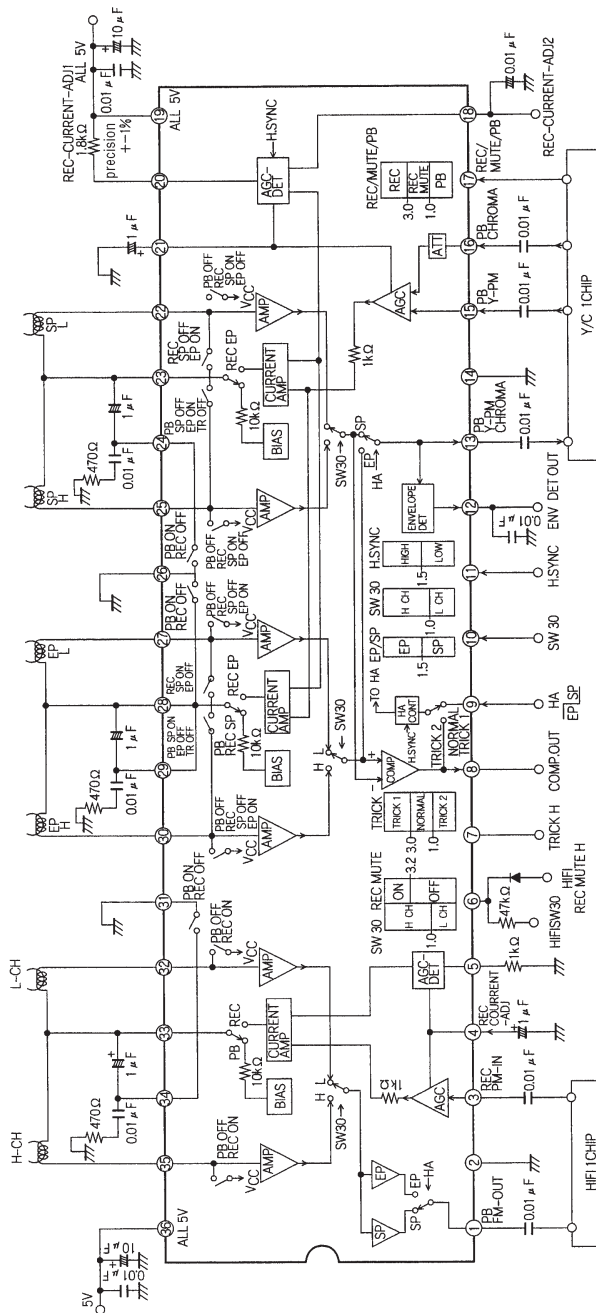
R_{O1} determines the recording current.

Design values

$R_{O1} = 1.0 \text{ k}\Omega = 24.0 \text{ mA (SP) (per channel)}$

$R_{O1} = 1.5 \text{ k}\Omega = 16.0 \text{ mA (EP)}$

Block Diagram



A8478

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