

Ordering number : EN5710A

Monolithic Linear IC



# LA70011, 70011M

## Recording/Playback Amplifier for VHS VCRs

### Overview

The LA70011 and LA70011M are 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.

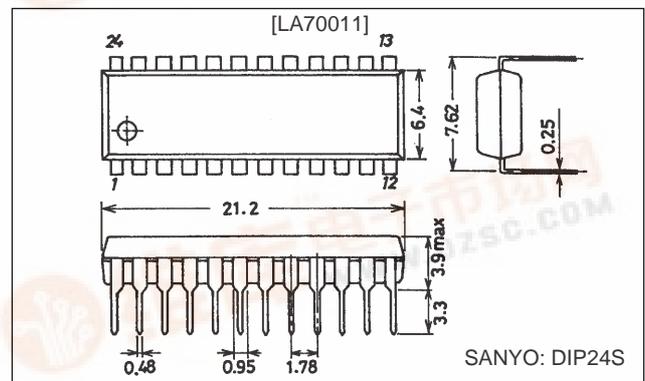
### Features

- 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.
- Using the same dimensions and pin assignments as the LA70001 and LA70001M permits the use of the same circuit boards as these earlier chips. The LA70011 can also be mounted at the right end of an LA70020 socket.

### Package Dimensions

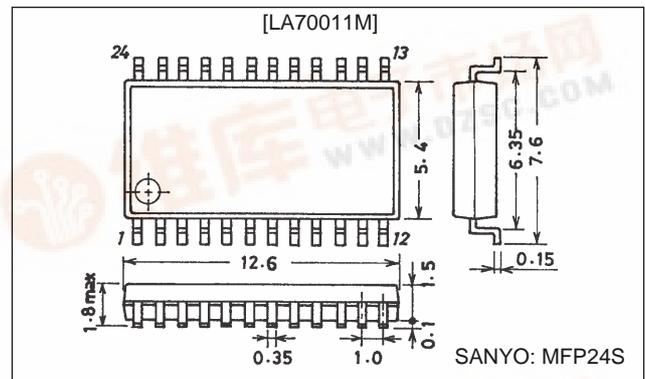
unit: mm

#### 3067-DIP24S



unit: mm

#### 3112-MFP24S



### Specifications

#### Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum power supply voltage	V <sub>CC</sub> max		7.0	V
Maximum power dissipation	Pd max	Ta ≤ 65°C [LA70011]	600	mW
		Ta ≤ 65°C [LA70011M] 114.3 × 76.1 × 1.6 mm: glass epoxy	500	mW
Operating temperature	Topr		-10 to +65	°C
Storage temperature	Tstg		-40 to +150	°C

#### Operating Conditions at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Recommended power supply voltage	V <sub>CC</sub>		5.0	V
Operating power supply voltage range	V <sub>CC</sub> op		4.8 to 5.5	V



## LA70011, 70011M

### Operating Characteristics at Ta = 25°C

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 $G_{VP1}$	$V_{IN} = 38 \text{ mVp-p}$ , $f = 1 \text{ MHz}$	56	59	62	dB
	SP-H CH2 $G_{VP2}$		56	59	62	
	EP-L CH3 $G_{VP3}$		56	59	62	
	EP-H CH4 $G_{VP4}$		56	59	62	
Voltage gain difference	$\Delta G_{VP1}$	$G_{VP1} - G_{VP2}$	-1	0	+1	dB
	$\Delta G_{VP2}$	$G_{VP3} - G_{VP4}$	-1	0	+1	
Intermode gain difference	$\Delta G_{VP3}$	$G_{VP3} - G_{VP1}$	-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	$\mu\text{Vrms}$
Frequency characteristic	CH1 CH2 CH3 CH4 $\Delta V_{fp1}$ $\Delta V_{fp2}$ $\Delta V_{fp3}$ $\Delta V_{fp4}$	Ratios of the output for $V_{IN} = 38 \text{ mVp-p}$ and $f = 7 \text{ MHz}$ to the voltage gains $G_{VP1}$ , $G_{VP2}$ , $G_{VP3}$ , and $G_{VP4}$ .	-2.5	0		dB
Secondary harmonic distortion	CH1 CH2 CH3 CH4 $\Delta V_{HDP1}$ $\Delta V_{HDP2}$ $\Delta V_{HDP3}$ $\Delta V_{HDP4}$	Ratio of the 8 MHz (secondary) component of the output to its 4 MHz (primary) component for $V_{IN} = 38 \text{ mVp-p}$ and $f = 4 \text{ MHz}$ .		-40	-35	dB
Maximum output level	CH1 CH2 CH3 CH4 $\Delta V_{OMP1}$ $\Delta V_{OMP2}$ $\Delta V_{OMP3}$ $\Delta V_{OMP4}$	Output level, for $f = 1 \text{ MHz}$ , 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 $V_{IN} = 38 \text{ mVp-p}$ and $f = 4 \text{ MHz}$ to $G_{VP1}$ .		-40	-35	dB
	$V_{CR2}$	Ratio of the output for $V_{IN} = 38 \text{ mVp-p}$ and $f = 4 \text{ MHz}$ to $G_{VP2}$ .		-40	-35	
Crosstalk EP	$V_{CR3}$	Ratio of the output for $V_{IN} = 38 \text{ mVp-p}$ and $f = 4 \text{ MHz}$ to $G_{VP3}$ .		-40	-35	dB
	$V_{CR4}$	Ratio of the output for $V_{IN} = 38 \text{ mVp-p}$ and $f = 4 \text{ MHz}$ to $G_{VP4}$ .		-40	-35	
Output DC offset	$\Delta V_{ODC1}$	CH1 — CH2	-100	0	+100	mV
	$\Delta V_{ODC2}$	CH3 — CH4				
	$\Delta V_{ODC3}$	CH1 — CH3				
	$\Delta V_{ODC4}$	CH2 — CH4				
	$\Delta V_{ODC5}$	CH1 — CH4				
	$\Delta V_{ODC6}$	CH2 — CH3				
Envelope detector output pin voltage	$V_{ENV}$	T6 DC level with no signal input.	0.0	08	1.3	V
Envelope detector output pin voltage SP	$V_{ENVSP1}$	T6 DC level at which T7A output level is 175 mVp-p for $f = 4 \text{ MHz}$ .	2.0	2.5	3.0	V
	$V_{ENVSP2}$	T6 DC level at which T7A output level is 400 mVp-p for $f = 4 \text{ MHz}$ .	4.0	4.5	5.0	
Envelope detector output pin voltage EP	$V_{ENVEP1}$	T6 DC level at which T7A output level is 125 mVp-p for $f = 4 \text{ MHz}$ .	2.0	2.5	3.0	V
	$V_{ENVEP2}$	T6 DC level at which T7A output level is 300 mVp-p for $f = 4 \text{ MHz}$ .	4.0	4.5	5.0	
Comparator output voltage	$V_{COMP1}$	T2 DC level for $V_{IN} = 38 \text{ mVp-p}$ and $f = 4 \text{ MHz}$ .		0.4	0.7	V
	$V_{COMP2}$	T2 DC level for $V_{IN} = 38 \text{ mVp-p}$ and $f = 4 \text{ MHz}$ .	4.5	4.8		
SW-Tr on resistance during playback	$R_{PON17}$ $R_{PON22}$	DC difference for 1 and 2 mA current inputs.		4	6	$\Omega$
Trick threshold level	TR1-1	Normal → Trick1 : *1	3.2		5.0	V
	TR1-2	Trick1 → Normal	1.2		2.8	
	TR2-1	Normal → Trick2 : *1	0.0		0.8	
	TR2-2	Trick2 → Normal	1.2		2.8	

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## LA70011, 70011M

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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 <sub>CCR</sub>	Current input at pin 13.	52	59	66	mA
REC AGC AMP output level	V <sub>RSP</sub>	Output level for V <sub>IN</sub> = 400 mVp-p and f = 4 MHz.	127	135	143	mVp-p
	V <sub>REP</sub>		104	111	119	mVp-p
Intermode gain difference	ΔGVR	VRSP/VREP	1.4	1.7	2.0	dB
REC AGC AMP control characteristic	ΔV <sub>AGC1-SP</sub> ΔV <sub>AGC1-EP</sub>	Output level divided by V <sub>RSP</sub> or V <sub>REP</sub> for f = 4 MHz and V <sub>IN</sub> = 700 mVp-p.		0.5	1.0	dB
	ΔV <sub>AGC2-SP</sub> ΔV <sub>AGC2-EP</sub>	Output level divided by V <sub>RSP</sub> or V <sub>REP</sub> for f = 4 MHz and V <sub>IN</sub> = 100 mVp-p.	-1.0	-0.5		dB
REC AGC AMP frequency characteristic	ΔV <sub>FRS</sub> ΔV <sub>FRE</sub>	Ratio of f = 7 MHz output to f = 1 MHz output for V <sub>IN</sub> = 400 mVp-p. *2	-1	0	+1	dB
REC AGC AMP secondary primary distortion	ΔV <sub>HDRS</sub> ΔV <sub>HDRE</sub>	Ratio of the 8 MHz (secondary) component of the output to its 4 MHz (primary) component for V <sub>IN</sub> = 400 mVp-p and f = 4 MHz.		-45	-40	dB
REC AGC AMP maximum output level	ΔV <sub>MOSP</sub> ΔV <sub>MOEP</sub>	Output level, for f = 4 MHz, at which the secondary distortion is -35 dB.	20	22		mApp
REC AGC AMP muting attenuation	ΔV <sub>MRS</sub> ΔV <sub>MRE</sub>	Output level divided by V <sub>RSP</sub> or V <sub>REP</sub> for f = 4 MHz and V <sub>IN</sub> = 400 mVp-p.		-45	-40	dB
REC AGC AMP cross modulation relative level	ΔV <sub>CYS</sub> ΔV <sub>CYE</sub>	Output ratio (4M ± 629k)/4M for V <sub>IN</sub> = 400 mVp-p and f = 4 MHz at T9A and V <sub>IN</sub> = 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 T5 (H-SYNC), the pin from which the LA70011 takes its T3 (HA) control switch timing.

\* The resistance between pins 13 and 14 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 15) to fix the AGC amplifier gain.

\*3. Apply a DC voltage to the REC-CUR-Adj pin (pin 12) and adjust the output level.

## LA70011, 70011M

### Pin Descriptions

Pin Number	Pin Name	Standard DC Voltage (V)		Equivalent Circuit	Notes				
1	TRICK-H				<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>Trick1</td> <td rowspan="3" style="vertical-align: middle;">3.0 V</td> </tr> <tr> <td>NORMAL</td> </tr> <tr> <td>Trick2</td> </tr> </table>	Trick1	3.0 V	NORMAL	Trick2
Trick1	3.0 V								
NORMAL									
Trick2									
2	COMP-OUT	PB	H: min. 4.5 V L: max. 0.7 V		EP > SP ENV High				
3	HA (EP/SP)				<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>EP</td> <td rowspan="2" style="vertical-align: middle;">1.0 V</td> </tr> <tr> <td>SP</td> </tr> </table>	EP	1.0 V	SP	
EP	1.0 V								
SP									
4	SW30				<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>Hch</td> <td rowspan="2" style="vertical-align: middle;">1.0 V</td> </tr> <tr> <td>Lch</td> </tr> </table>	Hch	1.0 V	Lch	
Hch	1.0 V								
Lch									
5	H-SYNC				<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>SYNC H</td> <td rowspan="2" style="vertical-align: middle;">1.5 V</td> </tr> <tr> <td>L</td> </tr> </table>	SYNC H	1.5 V	L	
SYNC H	1.5 V								
L									

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## LA70011, 70011M

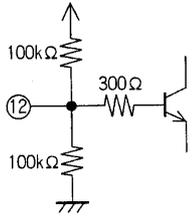
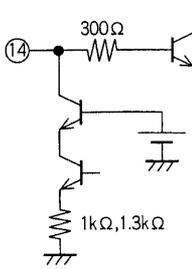
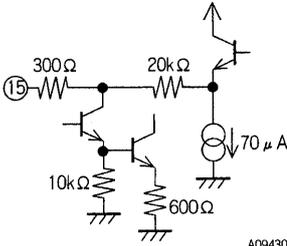
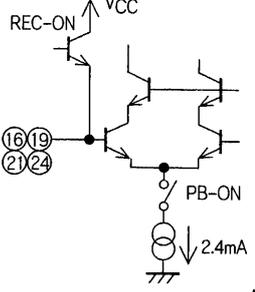
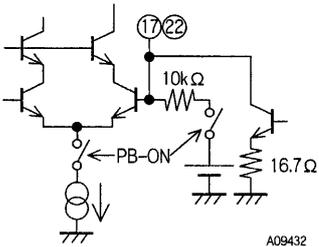
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Pin Number	Pin Name	Standard DC Voltage (V)		Equivalent Circuit	Notes					
6	ENVDET-OUT	PB	See relevant documents.	<p style="text-align: right;">A09423</p>						
		REC	0							
7	PB-OUT	PB	1.7	<p style="text-align: right;">A09424</p>						
		REC	2.1							
8 20	GND									
9	REC-Y-IN	PB	4.0	<p style="text-align: right;">A09425</p>						
		REC	3.7							
10	REC-C-IN	PB	4.0	<p style="text-align: right;">A09426</p>						
		REC	3.7							
11	REC/MUTE/PB			<p style="text-align: right;">A09427</p>	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="text-align: center;">REC</td> <td rowspan="2" style="vertical-align: middle;">3.0 V</td> </tr> <tr> <td style="text-align: center;">REC MUTE</td> </tr> <tr> <td style="text-align: center;">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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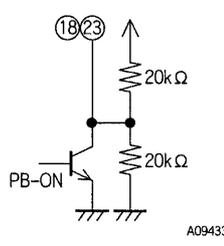
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Pin Number	Pin Name	Standard DC Voltage (V)		Equivalent Circuit	Notes
12	REC-CURRENT-ADJ2	PB	2.5 V	 <p style="text-align: right;">A09428</p>	
		REC	2.5 V		
13	V <sub>CC</sub>				
14	REC-CURRENT-ADJ1	PB	5.0	 <p style="text-align: right;">A09429</p>	
		REC	4.5		
15	REC-AGC-FILT	PB	0	 <p style="text-align: right;">A09430</p>	
		REC	1.6		
16 19 21 24	SP L-IN SP H-IN EP L-IN EP H-IN	PB	2.1	 <p style="text-align: right;">A09431</p>	
		REC	4.1		
17 22	REC SP OUT EP OUT	PB	2.1	 <p style="text-align: right;">A09432</p>	
		REC	4.1		

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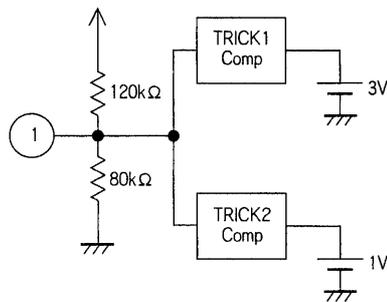
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Pin Number	Pin Name	Standard DC Voltage (V)		Equivalent Circuit	Notes
18 23	PB FILT	PB	0		
		REC	2.5		

### Usage Notes

#### Control Pin Logic

#### Switching Trick Mode with Pin 1



A09434

GND < pin 1 level - DC < 1.0 V: TRICK2  
 1.0 V < pin 1 level - DC < 3.0 V: NORMAL  
 3.0 V < pin 1 level - DC < 5.0 V: TRICK1

#### NORMAL Mode

Two channels selected with pin 3 (EP/SP): ON

Envelope comparator: OFF

#### TRICK1 and TRICK2 Modes

All four channels: ON

Envelope comparator: OFF

Difference between TRICK1 and TRICK2 modes (See the Block Diagram.)

TRICK1 is a special playback mode using the following path

Envelope comparator OUT (pin 2)

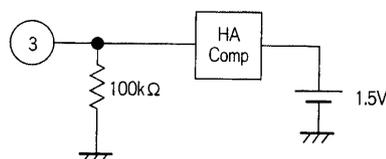
→
Servo (microcontroller)
→
Pin 3 (HA)
→
HA-SW

TRICK2 provides SP searching

Envelope comparator OUT

→
HA-SW

HA-SW (EP/SP mode switch): Pin 3



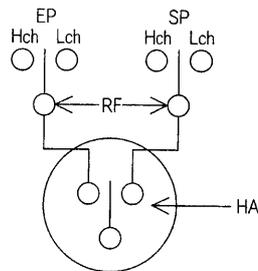
A09435

GND < pin 3 level - DC < 1.5 V: SP mode  
 1.5 V < pin 3 level - DC < 5 V: EP mode

## LA70011, 70011M

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

During playback, the LA70011's video circuits synchronize the HA-SW switching timing shown in the following figure with the H-SYNC signal from pin 5. (Other EP/SP switching takes place in real time.)

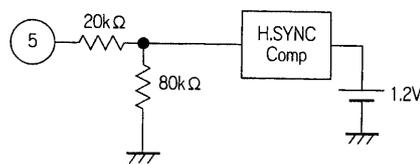


A09436

#### Comparator Output: Pin 2

- EP envelope > SP envelope: High (min. 4.0 V)
- EP envelope < SP envelope: Low (max. 0.7 V)

#### H-SYNC Input: Pin 5



Pin 5 level - DC > 1.5 V: H-SYNC interval

A09437

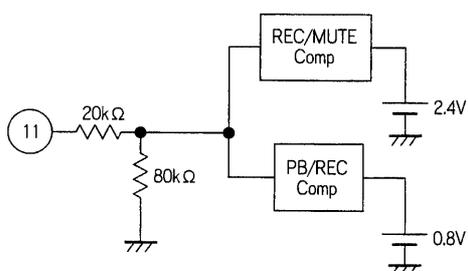
#### Playback:

- 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 11



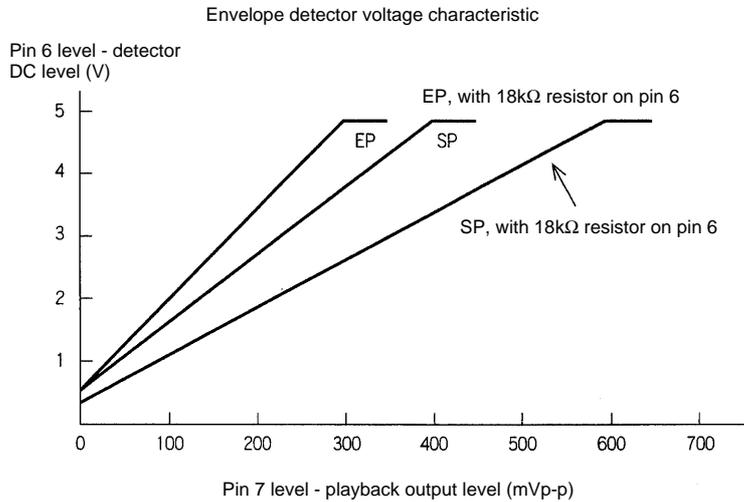
- GND < pin 11 level - DC < 1.0 V: PB mode
- 1.0 V < pin 11 level - DC < 3.0 V: REC mode, REC-MUTE
- 3.0 V < pin 11 level - DC < 5.0 V: REC mode

A09438

## LA70011, 70011M

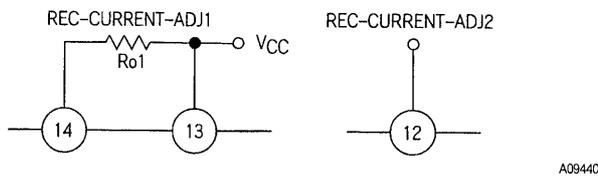
### Envelope Detector Characteristic: Pin 6

The LA70011 includes a built-in playback signal envelope detector circuit for use in automating tracking adjustment.



### REC AMP Gain Control

The LA70011 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.



### REC-CURRENT-ADJ2 Open

The internal bias forces the DC level at pin 12 to  $1/2 V_{CC}$  (that is, approximately 2.5 V), and  $R_{O1}$  determines the recording current.

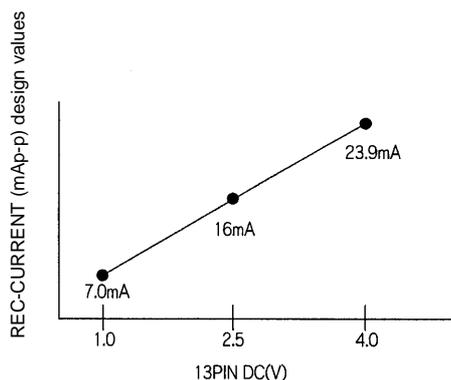
### Design values

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

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

### REC-CURRENT-ADJ2 Used

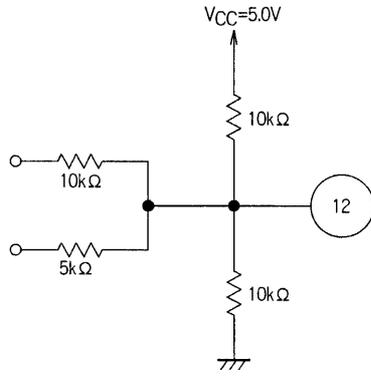
Applying a DC control voltage between 1 and 4 V to pin 12 adjusts the figure determined by  $R_{O1}$  between  $-6.0 \text{ dB}$  and  $+3.5 \text{ dB}$ .



## LA70011, 70011M

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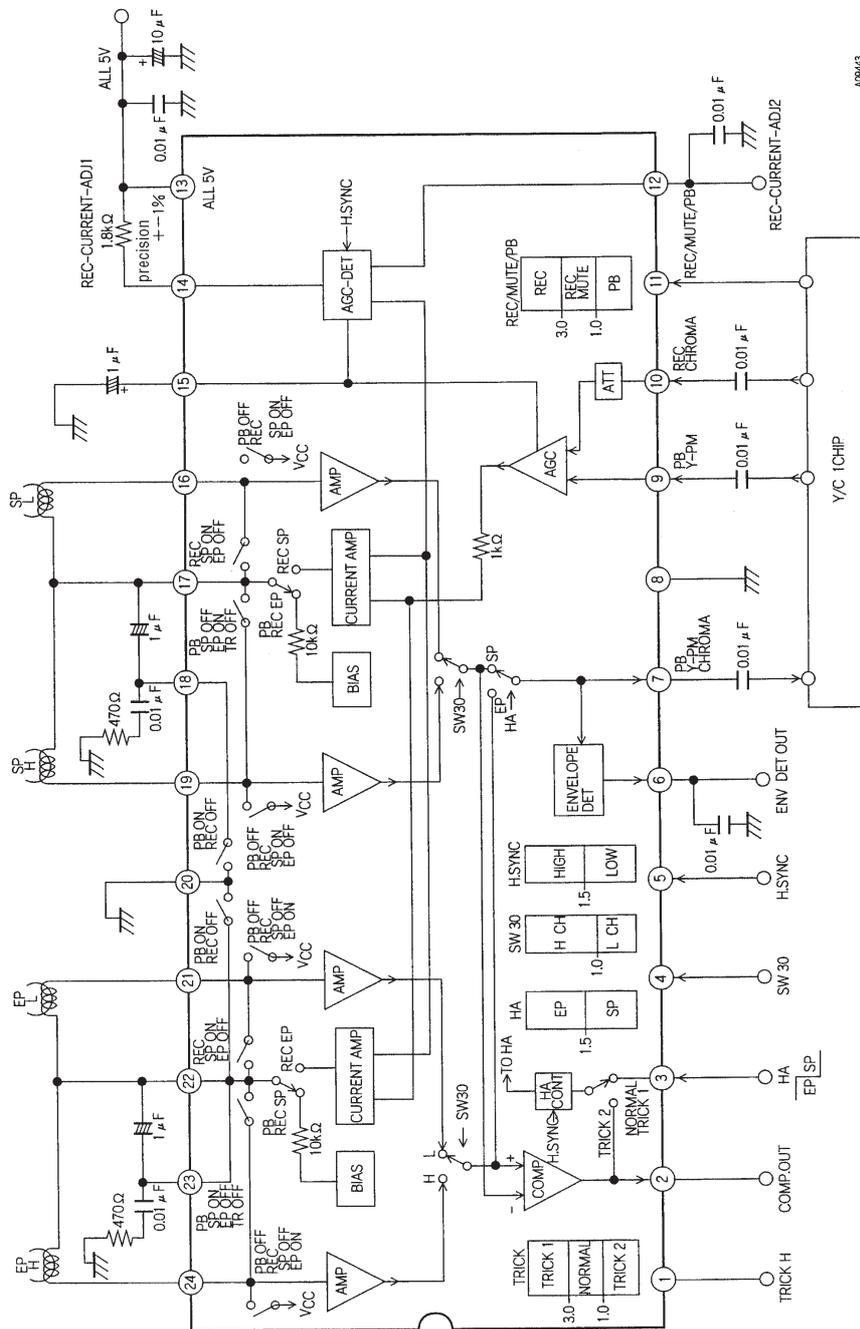
Note: One possible circuit for applying this voltage is the following, which provides 9 modes between 1 and 4 V.



A09442

# LA70011, 70011M

## Block Diagram



408443

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