



## VHS VCR Playback Head and Record Amplifiers

### Overview

The LA7415 is a record and playback amplifier IC for VHS format VCR decks. In combination with a Sanyo LC7420 or LA7430 Series video signal processing IC, the LA7415 can provide an adjustment-free Y/C record current.

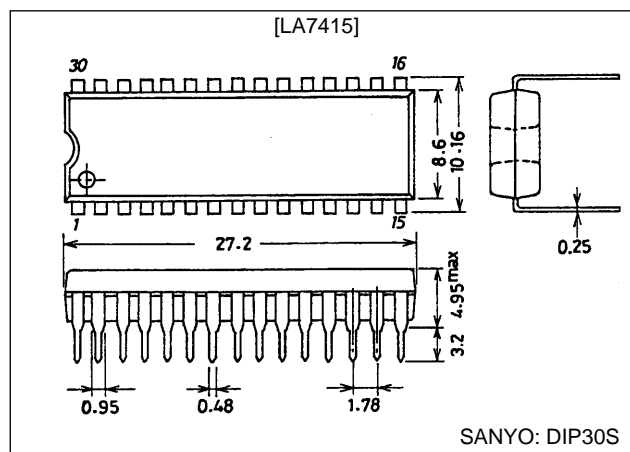
### Features

- Record amplifier: Provides stable recording characteristics using a fixed-current drive technique that is resistant to load variations.
- REC-AMP: Includes a built-in AGC circuit.
- Can use the same printed circuit board as the LA7411.

### Package Dimension

unit: mm

#### 3061-DIP30S



### Specifications

#### Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V <sub>CC</sub> max		7.0	V
Allowable power dissipation	P <sub>d</sub> max	Ta 65 °C	650	W
Operating temperature	T <sub>opr</sub>		-10 to +65	°C
Storage temperature	T <sub>stg</sub>		-40 to +150	°C

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

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage	V <sub>CC</sub>		5.0	V
Operating voltage range	V <sub>CCop</sub>		4.8 to 5.5	V

## Electrical Characteristics at Ta = 25°C

Parameter	Symbol	Conditions		Ratings			Unit					
		Input	Output	T2	T4	T5		min	typ	max		
[Playback Mode]				T15: 5.0 V, T13: OPEN, T7: OPEN	TRCK	HA	SW30 MUTE					
Current drain	I <sub>CCP</sub>			Pin 15 influx current	OPEN	0	0	24	30	36	mA	
Voltage gain	SP L CH1	V <sub>GP1</sub>	T20A	T10A	V <sub>IN</sub> = 38 mVp-p, f = 1 MHz	OPEN	0	0	54.0	57.0	60.0	dB
	SP H CH2	V <sub>GP2</sub>	T23A	T10A		OPEN	0	2.5	54.0	57.0	60.0	dB
	EP L CH3	V <sub>GP3</sub>	T27A	T10A		OPEN	5.0	0	56.0	59.0	62.0	dB
	EP H CH4	V <sub>GP4</sub>	T30A	T10A		OPEN	5.0	2.5	56.0	59.0	62.0	dB
Voltage gain differential 1	V <sub>Gp1</sub>	-	-	V <sub>GP1</sub> - V <sub>GP2</sub>	-	-	-	-1	0	+1	dB	
Voltage gain differential 2	V <sub>Gp2</sub>	-	-	V <sub>GP3</sub> - V <sub>GP4</sub>	-	-	-	-1	0	+1	dB	
Inter-mode gain difference	V <sub>GP EP-SP</sub>	-	-	V <sub>GP3</sub> - V <sub>GP1</sub>	-	-	-	1	2	3	dB	
Equivalent input noise voltage	CH1	V <sub>NIN1</sub>	T20A	T10A	After the 1.1-MHz LPF $\frac{V_{OUT}}{V_{GP1, 2, 3, 4}}$	OPEN	0	0	-	1.1	1.5	μVrms
	CH2	V <sub>NIN2</sub>	T23A	T10A		OPEN	0	2.5	-	1.1	1.5	μVrms
	CH3	V <sub>NIN3</sub>	T27A	T10A		OPEN	5.0	0	-	1.1	1.5	μVrms
	CH4	V <sub>NIN4</sub>	T30A	T10A		OPEN	5.0	2.5	-	1.1	1.5	μVrms
Frequency characteristics	CH1	V <sub>fp1</sub>	T20A	T10A	V <sub>IN</sub> = 38 mVp-p f = 7 MHz $\frac{V_{OUT}}{V_{GP1, 2, 3, 4}}$ output ratio	OPEN	0	0	-2.5	0	-	dB
	CH2	V <sub>fp2</sub>	T23A	T10A		OPEN	0	2.5	-2.5	0	-	dB
	CH3	V <sub>fp3</sub>	T27A	T10A		OPEN	5.0	0	-2.5	0	-	dB
	CH4	V <sub>fp4</sub>	T30A	T10A		OPEN	5.0	2.5	-2.5	0	-	dB
Second harmonic distortion	CH1	V <sub>HDP1</sub>	T20A	T10A	V <sub>IN</sub> = 38 mVp-p f = 4 MHz (8-MHz component)/(4-MHz component) output ratio	OPEN	0	0	-	-40	-35	dB
	CH2	V <sub>HDP2</sub>	T23A	T10A		OPEN	0	2.5	-	-40	-35	dB
	CH3	V <sub>HDP3</sub>	T27A	T10A		OPEN	5.0	0	-	-40	-35	dB
	CH4	V <sub>HDP4</sub>	T30A	T10A		OPEN	5.0	2.5	-	-40	-35	dB
Maximum output level	CH1	V <sub>OMP1</sub>	T20A	T10A	f = 1 MHz The output level when the third harmonic in the output is -30 dB	OPEN	0	0	1.0	1.2	-	Vp-p
	CH2	V <sub>OMP2</sub>	T23A	T10A		OPEN	0	2.5	1.0	1.2	-	Vp-p
	CH3	V <sub>OMP3</sub>	T27A	T10A		OPEN	5.0	0	1.0	1.2	-	Vp-p
	CH4	V <sub>OMP4</sub>	T30A	T10A		OPEN	5.0	2.5	1.0	1.2	-	Vp-p
Crosstalk SP (Note 1)	CH1	V <sub>CR1</sub>	T23A	T10A	V <sub>IN</sub> = 38 mVp-p, f = 4 MHz $\frac{V_{OUT}}{V_{GP1, 2}}$	OPEN	0	0	-	-40	-35	dB
			T27A	T10A		OPEN	0	0	-	-40	-35	dB
			T30A	T10A		OPEN	0	0	-	-40	-35	dB
	CH2	V <sub>CR2</sub>	T20A	T10A		OPEN	0	2.5	-	-40	-35	dB
			T27A	T10A		OPEN	0	2.5	-	-40	-35	dB
			T30A	T10A		OPEN	0	2.5	-	-40	-35	dB
Crosstalk EP (Note 1)	CH3	V <sub>CR3</sub>	T23A	T10A	V <sub>I</sub> = 38 mVp-p, f = 4 MHz $\frac{V_{OUT}}{V_{GP3, 4}}$	OPEN	5.0	0	-	-40	-35	dB
			T27A	T10A		OPEN	5.0	0	-	-40	-35	dB
			T30A	T10A		OPEN	5.0	0	-	-40	-35	dB
	CH4	V <sub>CR4</sub>	T20A	T10A		OPEN	5.0	2.5	-	-40	-35	dB
			T27A	T10A		OPEN	5.0	2.5	-	-40	-35	dB
			T30A	T10A		OPEN	5.0	2.5	-	-40	-35	dB
Output DC offset	V <sub>ODC1</sub>	-	T10	CH1-CH2	OPEN	-	0	-100	0	+100	mV	
					OPEN	0	2.5	-100	0	+100	mV	
	V <sub>ODC2</sub>	-	T10	CH3-CH4	OPEN	-	0	-100	0	+100	mV	
					OPEN	5.0	2.5	-100	0	+100	mV	
	V <sub>ODC3</sub>	-	T10	CH1-CH3	OPEN	0	-	-100	0	+100	mV	
					OPEN	5.0	0	-100	0	+100	mV	
	V <sub>ODC4</sub>	-	T10	CH2-CH4	OPEN	0	-	-100	0	+100	mV	
					OPEN	5.0	2.5	-100	0	+100	mV	
	V <sub>ODC5</sub>	-	T10	CH1-CH4	OPEN	0	0	-100	0	+100	mV	
					OPEN	5.0	2.5	-100	0	+100	mV	
	V <sub>ODC6</sub>	-	T10	CH2-CH3	OPEN	0	2.5	-100	0	+100	mV	
					OPEN	5.0	0	-100	0	+100	mV	

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Note 1. With the input inductor L (8.2 μH) shorted.

2. Since the T4 (HA) control switch timing is synchronized with T6 (H-Sync), a T6 trigger (0 - 5 V - 0) must be input before measuring each of these items.

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Parameter	Symbol	Conditions		Ratings			min	typ	max	Unit	
		Input	Output	T2	T4	T5					
				T15: 5.0 V, T13: OPEN, T7: OPEN	TRCK	HA	SW30 MUTE				
Enveloped detector output pin voltage	V <sub>ENV</sub>		T8	The T8 DC voltage with no input	OPEN	0	0	0	0.4	0.8	V
Enveloped detector voltage SP1	V <sub>ENVSP1</sub>	T20A	T8	f = 4 MHz T10A: Adjusted to 300 mV p-p	OPEN	0	0	2.1	2.6	3.1	V
Enveloped detector voltage SP2	V <sub>ENVSP2</sub>	T20A	T8	f = 4 MHz T10A: Adjusted to 600 mV p-p	OPEN	0	0	4.5	4.8	5.0	V
Enveloped detector voltage EP1	V <sub>ENVEP1</sub>	T27A	T8	f = 4 MHz T10A: Adjusted to 200 mV p-p	OPEN	5.0	0	2.0	2.6	3.0	V
Enveloped detector voltage EP2	V <sub>ENVEP2</sub>	T27A	T8	f = 4 MHz T10A: Adjusted to 450 mV p-p	OPEN	5.0	0	4.5	4.8	5.0	V
Comparator output voltage 1	V <sub>COMP1</sub>	T20A	T3	f = 4 MHz, V <sub>IN</sub> = 38 mVp-p The T3 DC voltage	5.0	0	0	–	0.4	0.7	V
Comparator output voltage 2	V <sub>COMP2</sub>	T20A	T3	f = 4 MHz, V <sub>IN</sub> = 38 mVp-p The T3 DC voltage	5.0	5.0	0	4.5	4.8	–	V
Playback mode on switching transistor on resistance	R <sub>PON17</sub>		P-17	The difference in the DC measurement for 1-mA and 2-mA influx currents	–	–	–	–	4.0	6.0	
	R <sub>PON18</sub>		P-18		–	–	–	–	4.0	6.0	
Playback mode mode switching transistor on resistance	R <sub>PON21</sub>		P-21	The difference in the DC measurement for 1-mA and 2-mA influx currents	OPEN	5.0	–	–	4.0	6.0	
	R <sub>PON24</sub>		P-24		OPEN	5.0	–	–	4.0	6.0	
	R <sub>PON26</sub>		P-26		OPEN	0	–	–	4.0	6.0	
	R <sub>PON29</sub>		P-29		OPEN	0	–	–	4.0	6.0	
Trick 1 threshold level	TR1-1		T2	Normal → Trick1	*	–	–	3.2	–	5.0	V
	TR1-2		T2	Trick1 → Normal	*	–	–	1.2	–	2.8	V
Trick 2 threshold level	TR2-1		T2	Normal → Trick2	*	–	–	0.0	–	0.8	V
	TR2-2		T2	Trick2 → Normal	*	–	–	1.2	–	2.8	V
HAPB threshold level	HAP-1		T4	SP → EP	–	*	–	1.8	–	5.0	V
	HAP-2		T4	EP → SP	–	*	–	0.0	–	1.4	V
SW30 threshold level	SW30-1		T5	Lch → Hch	–	–	*	1.2	–	5.0	V
	SW30-2		T4	Hch → Lch	–	–	*	0.0	–	0.8	V
					T2	T4	T5				
[Record Mode]				T15: 5.0 V, T2: OPEN, T6: 5.0 V, T7: 5.0 V	REC Adj2	HA	SW30 MUTE				
Current drain	I <sub>CCR</sub>			The pin 15 influx current	OPEN	0	0	44	55	66	mA
AGC amplifier output level	V <sub>RSP</sub>	T11A	T21A	f = 4 MHz V <sub>IN</sub> = 200 mVp-p	OPEN	0	0	147	156	165	mVp-p
	V <sub>REP</sub>	T11A	T26A		OPEN	5.0	0	116	123	130	mVp-p
Inter-mode gain difference	V <sub>G R</sub>	–	–	V <sub>RSP</sub> /V <sub>REP</sub>	–	–	–	1.30	2.05	2.80	dB
AGC amplifier control characteristics 1	V <sub>AGC1-SP</sub>	T11A	T21A	f = 4 MHz, V <sub>IN</sub> = 400 mVp-p The output level/V <sub>RSP, EP</sub> ratio	OPEN	0	0	–	0.5	1.0	dB
	V <sub>AGC1-EP</sub>	T11A	T26A		OPEN	5.0	0	–	0.5	1.0	dB
AGC amplifier control characteristics 2	V <sub>AGC2-SP</sub>	T11A	T21A	f = 4 MHz, V <sub>IN</sub> = 100 mVp-p The output level/V <sub>RSP, EP</sub> ratio	OPEN	0	0	–1.0	–0.5	–	dB
	V <sub>AGC2-EP</sub>	T11A	T26A		OPEN	5.0	0	–1.0	–0.5	–	dB
AGC amplifier frequency characteristics	V <sub>FRS</sub>	T11A	T21A	f = 1 MHz, 7 MHz, V <sub>IN</sub> = 100 mVp-p The 7 MHz/1 MHz output ratio	OPEN	0	0	–1.0	–0.0	+1.0	dB
	V <sub>FRE</sub>	T11A	T26A		OPEN	5.0	0	–1.0	–0.0	+1.0	dB
AGC amplifier second harmonic distortion	V <sub>HDRS</sub>	T11A	T21A	f = 4 MHz, V <sub>IN</sub> = 200 mVp-p The (8 MHz component)/(4 MHz component) output ratio	OPEN	0	0	–	–45	–40	dB
	V <sub>HDRE</sub>	T11A	T21A		OPEN	5.0	0	–	–45	–40	dB
AGC amplifier maximum output level	V <sub>OMRS</sub>	T11A	T21A	f = 4 MHz, The output level for which the second harmonic is –35 dB	Adj.	0	0	20	22	–	mAp-p
	V <sub>OMRE</sub>	T11A	T26A		Adj.	5.0	0	20	22	–	mAp-p
AGC amplifier muting attenuation	V <sub>MRS</sub>	T11A	T21A	f = 4 MHz, V <sub>I</sub> = 200 mVp-p The output level/V <sub>RSP, EP</sub> ratio	OPEN	0	5.0	–	–45	–40	dB
	V <sub>MRE</sub>	T11A	T26A		OPEN	5.0	5.0	–	–45	–40	dB

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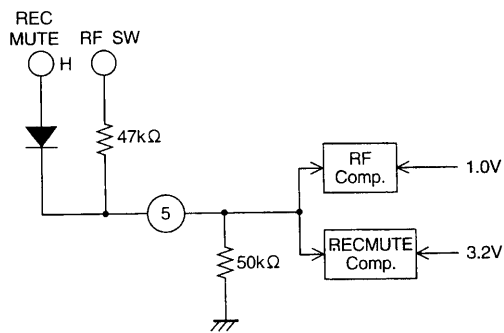
Parameter	Symbol	Conditions		Ratings			Unit				
		Input	Output	T2	T4	T5		min	typ	max	
[Record Mode]				T15: 5.0 V, T2: OPEN, T6: 5.0 V, T7: 5.0 V	REC Adj2	HA	SW30 MUTE				
AGC amplifier relative cross modulation level	V <sub>CYS</sub>	T10A	T21A	T10A: f = 629 kHz, V <sub>IN</sub> = 360 mVp-p T11A: f = 4 MHz, V <sub>IN</sub> = 200 mVp-p (4 MHz ±629 kHz)/(4 MHz) output ratio	OPEN	0	0	-	-45	-40	dB
	V <sub>CYE</sub>	T11A	T26A		OPEN	5.0	0	-	-45	-40	dB
Record mode mode switching transistor on resistance	R <sub>RON</sub> 17		P-17	The difference in the DC measurement for 1-mA and 2-mA influx currents	OPEN	5.0	-	-	4.0	6.0	
	R <sub>RON</sub> 18		P-18		OPEN	0	-	-	4.0	6.0	
	R <sub>RON</sub> 21		P-21		OPEN	5.0	-	-	4.0	6.0	
	R <sub>RON</sub> 24		P-24		OPEN	5.0	-	-	4.0	6.0	
	R <sub>RON</sub> 26		P-26		OPEN	0	-	-	4.0	6.0	
	R <sub>RON</sub> 29		P-29		OPEN	0	-	-	4.0	6.0	
HA record threshold level	HAR-1		T4	SP → EP	-	*	-	1.8	-	5.0	V
	HAR-2		T4	EP → SP	-	*	-	0.0	-	1.4	V
Record MUTE threshold level	MUTE-1		T5	MUTE OFF → ON	-	-	*	3.4	-	5.0	V
	MUTE-2		T5	MUTE ON → OFF	-	-	*	0.0	-	3.0	V
Record/playback threshold level	SW REC/PB			T7: control voltage	-	-	-	2.2	-	5.0	V

- Notes 3. Measure with a DC voltage of about 1.8 V applied to the AGC detector filter pin (pin 12) and with the AGC amplifier gain fixed.  
 4. Adjust the output level by applying a DC voltage to T13 (REC CUR.Adj2)  
 5. Use a resistor with a ±1.0% tolerance between pins 14 and 15.

### Usage Notes

#### 1. Control Pin Logic

RF SW, REC MUTE: pin 5



Playback mode

If the pin 5 DC voltage is < 1.0 V: Lch

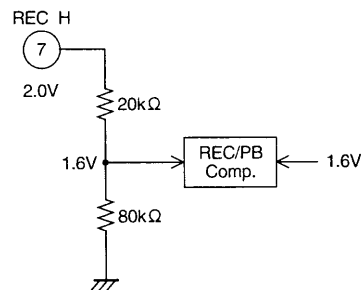
If the pin 5 DC voltage is > 1.0 V: Hch

Record mode

If the pin 5 DC voltage is < 3.2 V: Muting will be off

If the pin 5 DC voltage is > 3.2 V: Muting will be on

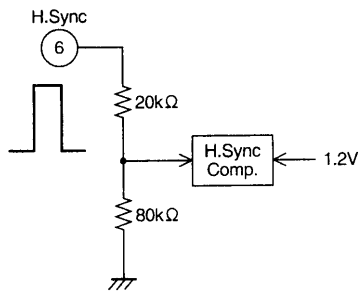
Record/playback mode switching: pin 7



If the pin 7 DC voltage is < 2.0 V: Playback mode

If the pin 7 DC voltage is > 2.0 V: Record mode

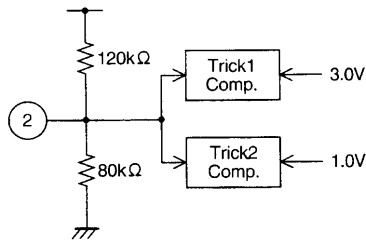
H.Sync input: pin 6



If the pin 6 DC voltage is > 1.5 V: Currently the signal is in an H.Sync period

\*: Playback mode: Used for switching timing in SP search.  
 Record mode: Used as the record amplifier AGC synchronization block gate pulse.

(4) Playback trick mode switching: pin 2



If the pin 2 DC voltage is > 3.0 V: Trick 1  
 If the pin 2 DC voltage is < 1.0 V: Trick 2  
 If the pin 2 DC voltage is > 1.0 V and < 3.0 V: Normal

\*: Normal mode: Two channels controlled (EP/SP) by pin 4: ON  
 Envelope comparator: OFF

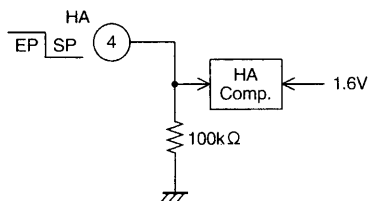
In trick 1 and 2 modes: All 4 channels: ON  
 Envelope comparator: ON

\*: The difference between trick 1 and trick 2 is that:

Trick1 Envelope comparator (pin 3) output → Servo (microcontroller)<sup>or</sup>  
 → Pin 4 HA → SP search is performed in the HA switch path.

Trick2 Envelope comparator output → SP search is performed in the HA switch path. (See the block diagram.)

HA SW (EP/SP mode switching): pin 4

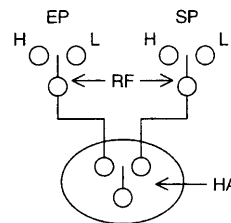


If the pin 4 DC voltage is < 1.6 V: SP mode

If the pin 4 DC voltage is > 1.6 V: EP mode

\*: H.Sync synchronization for HA switching:

The switching of the HA SW circuit show in the figure at the right is synchronized with the H.Sync signal input to pin 6. (Other EP/SP switching is performed in real time.)



Comp.OUT (pin 3)

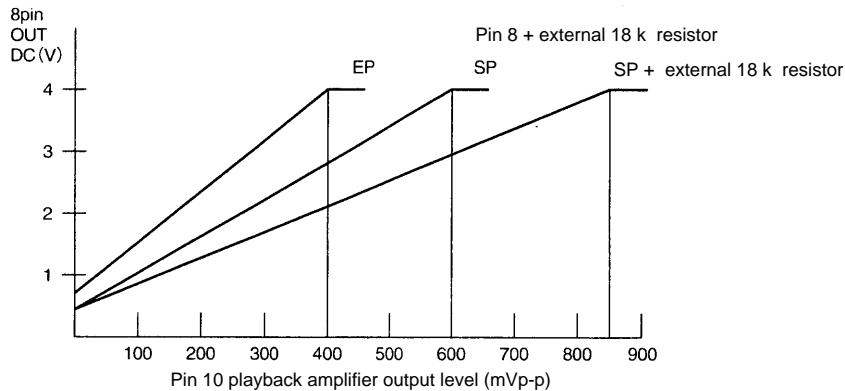
If the EP envelope is > SP: High (4.0 V or higher)

If the EP envelope is < SP: Low (0.7 V or lower)

## 2. Envelope Detector Characteristics: pin 8

The LA6529M includes an on-chip playback signal envelope detector circuit used to achieve automatic tracking adjustment with essentially linear characteristics.

### Envelope Detector Characteristics (design target values) $f = 4 \text{ MHz}$

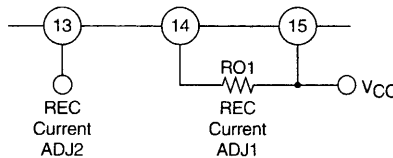


## 3. Record Amplifier Gain Control

The LA6529M achieves an adjustment-free record current by adding an AGC circuit in the record amplifier block. The record current can be modified using the circuit shown below.

(1) REC Current.Adj2: When open

The pin 13 DC level is set to  $1/2 V_{CC}$  (about 2.5 V) by an internal bias and the record current is determined by RO1.



Design values: RO1: 1.5 k = 15.6 mAp-p (SP) (per channel)  
= 12.3 mAp-p (EP)

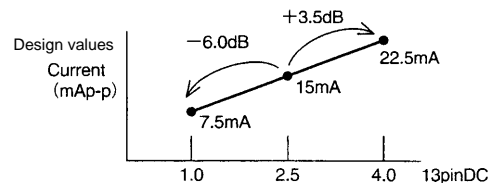
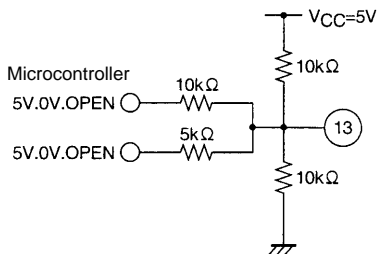
(2) REC Current.Adj2: When used

The value determined by RO1 can be adjusted from  $-6.0 \text{ dB}$  to  $+3.5 \text{ dB}$  by applying a control DC level (1 to 4 V) to pin 13.

(Reference)

The circuit below can be used to apply the DC control level to pin 13.

This allows 9 modes (1 to 4 V) to be applied.



Pin Functions

Pin No.	Pin	Standard DC voltage (V)		Pin circuit	Notes										
1 19 22 28	PB Amp Second filter	PB	2.0												
		REC	3.6												
2	TRICK-H				<table border="1"> <tr><td>3.0 V</td></tr> <tr><td>NORMAL</td></tr> <tr><td>1.0 V</td></tr> <tr><td>Trick2</td></tr> </table>	3.0 V	NORMAL	1.0 V	Trick2						
3.0 V															
NORMAL															
1.0 V															
Trick2															
3	COMP-OUT	PB	High: 4.5 V or higher Low: 0.7 V or lower		EP > SP ENV: High										
		REC	OPEN												
4	HA (EP/SP)				<table border="1"> <tr><td>1.6 V</td></tr> <tr><td>EP</td></tr> <tr><td>SP</td></tr> </table>	1.6 V	EP	SP							
1.6 V															
EP															
SP															
5	RF-SW (REC-MUTE)				<table border="1"> <tr><td colspan="2">SW30 REC MUTE</td></tr> <tr><td>Hch</td><td>ON</td></tr> <tr><td>Lch</td><td>OFF</td></tr> <tr><td colspan="2">3.2 (V)</td></tr> <tr><td colspan="2">1.0 (V)</td></tr> </table>	SW30 REC MUTE		Hch	ON	Lch	OFF	3.2 (V)		1.0 (V)	
SW30 REC MUTE															
Hch	ON														
Lch	OFF														
3.2 (V)															
1.0 (V)															
6	H-SYNC				<table border="1"> <tr><td>1.5 V</td></tr> <tr><td>Sync</td></tr> <tr><td>H</td></tr> <tr><td>L</td></tr> </table>	1.5 V	Sync	H	L						
1.5 V															
Sync															
H															
L															

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Pin No.	Pin	Standard DC voltage (V)		Pin circuit	Notes
		PB	REC		
7	REC-H	PB	0		
		REC	5		
8	ENV DET OUT	PB	Described in a separate document.		
		REC	0		
9	GND				
10	PB-OUT	PB	2.3		
	REC-C-IN	REC	3.6		
11	REC-Y-IN	REC	3.6		
12	AGC-FLT	PB	1.6		
		REC	1.6		
13	REC-CURRENT ADJ2	PB	2.5		<p>4 V: +3.5 dB                      2.5 V: ±0 dB (OPEN)                      1 V: -6 dB</p>
		REC	2.5		

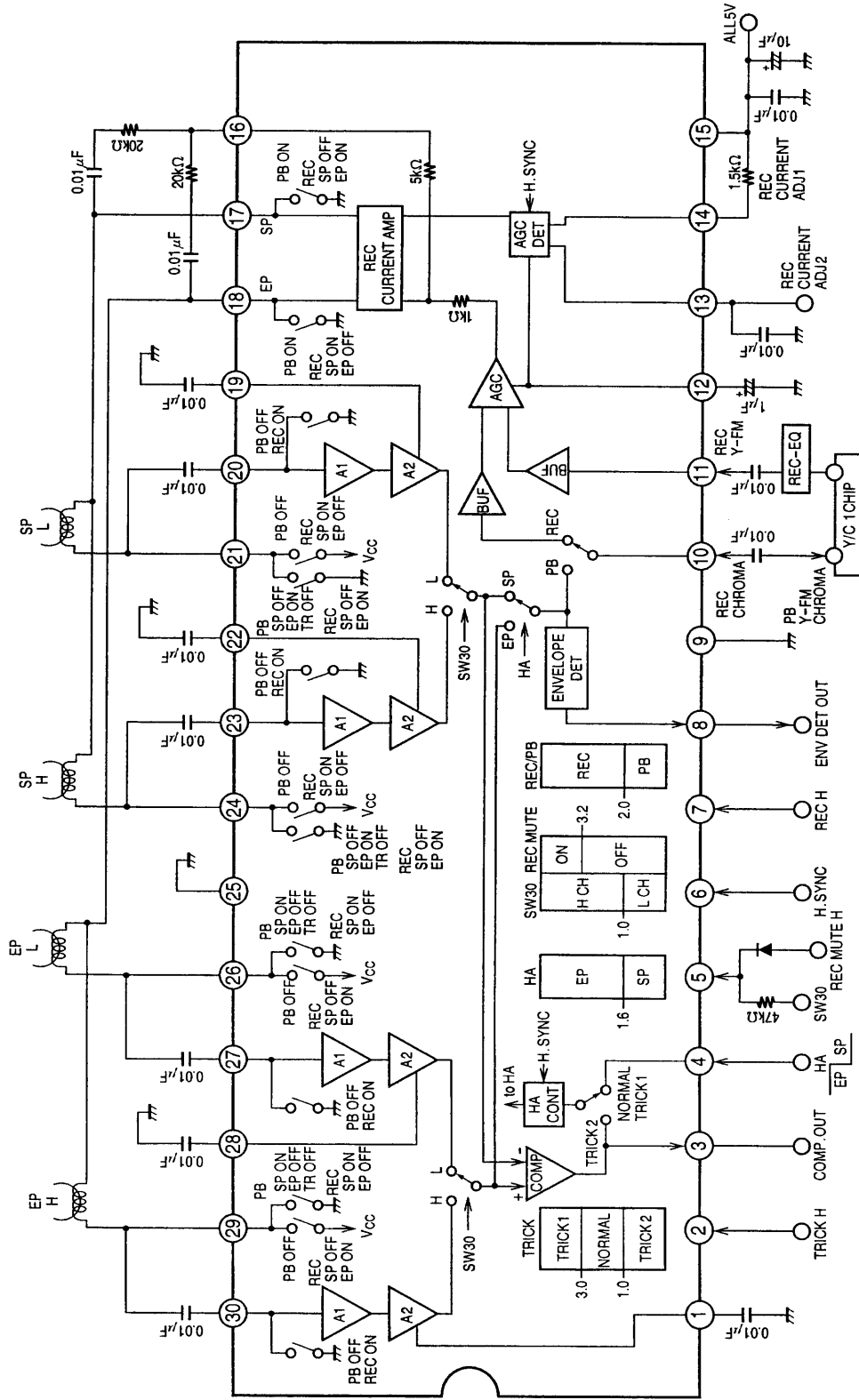
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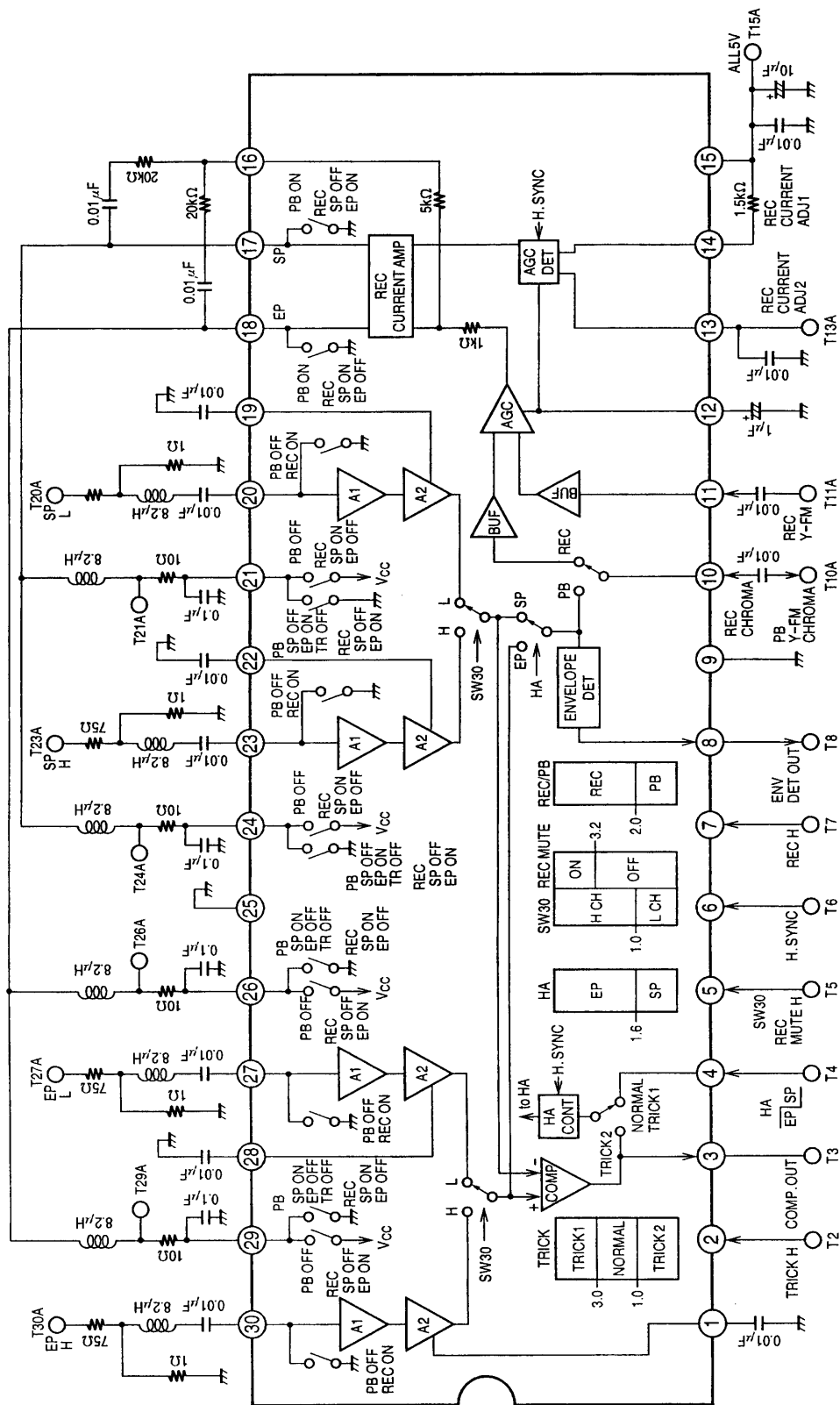
Pin No.	Pin	Standard DC voltage (V)		Pin circuit	Notes
		PB	REC		
14	REC-CURRENT ADJ1	PB	4.5		
		REC	5.0		
15	V <sub>CC</sub>				
16	REC-BIAS	PB	2.5		
		REC	1.7		
17	REC-SP OUT	PB	0		
18	REC-EP OUT	REC	4.2		
20	SP-L-IN	PB	0.7		
23	SP-H-IN				
27	EP-L-IN	REC	0		
30	EP-H-IN				
21	SP-L-SW	PB	0		
24	SP-H-SW				
26	EP-L-SW	REC	4.2		
29	EP-H-SW				
25	PRE-GND				

Block Diagram



T00060

Test Circuit



T00061

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