

# LA7416

# LA7416M

Monolithic Linear IC

## Playback Amplifier and Record Amplifier for VHS VCRs

### Overview

The LA7416 and LA7416M are playback and record amplifier ICs for four-head VHS VCRs. When used in conjunction with the video signal processing ICs of the LA7420/30 series, it is possible to eliminate the need to adjust the Y/C record current.

### Functions

- 4-channel playback amplifier.
- 2-channel recording amplifier (AGC built-in).
- REC/PB mode switching head switch circuit.
- Envelope wave detection (for auto-tracking).
- Envelope comparator.

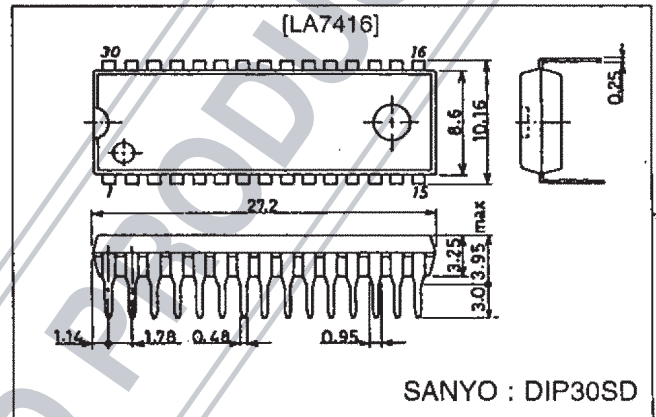
### Features

- The record amplifier provides stable record characteristics in constant current drive mode, which is able to withstand load fluctuations. In addition, the built-in AGC eliminates the need to adjust the record current.
- Designed to share printed circuit boards with the LA7411/7411M (for 2-head systems).

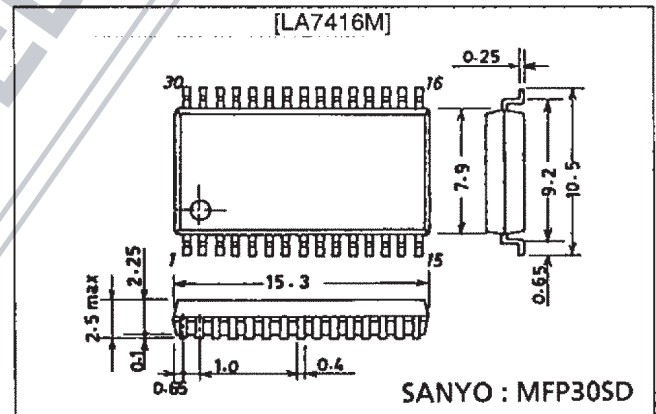
### Package Dimensions

unit : mm

#### 3196-DIP30SD



#### 3073A- MFP30SD



### Specifications

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

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	$V_{CCmax}$		7.0	V
Allowable power dissipation	$P_d\ max$	$T_a \leq 65\text{ }^\circ\text{C}$	650	mW
			*500	mW
Operating temperature	$T_{opr}$		-10 to +65	$^\circ\text{C}$
Storage temperature	$T_{stg}$		-40 to +150	$^\circ\text{C}$

\*: LA7416M  $P_d\ max$  value which represents the value when mounted on the board.

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## 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	Input	Output	Conditions	T2	T4	T5	min	typ	max	Unit		
[PB Mode]				T15: 5.0 V T13: Open T7: Open	TRCK	HA	SW30 MUTE						
Current consumption	I <sub>CCP</sub>			Pin 15 input current	Open	0	0	26	30	34	mA		
Voltage gain	SP L	CH1	G <sub>Vp1</sub>	T20A	T10A	V <sub>I</sub> = 38 mVp-p f = 1 MHz	Open	0	0	54.0	57.0	60.0	dB
	SP H	CH2	G <sub>Vp2</sub>	T23A	T10A		Open	0	2.5	54.0	57.0	60.0	dB
	EP L	CH3	G <sub>Vp3</sub>	T27A	T10A		Open	5.0	0	56.0	59.0	62.0	dB
	EP H	CH4	G <sub>Vp4</sub>	T30A	T10A		Open	5.0	2.5	56.0	59.0	62.0	dB
Voltage gain difference 1	ΔG <sub>Vp1</sub>			G <sub>Vp1</sub> — G <sub>Vp2</sub>				-1	0	+1	dB		
Voltage gain difference 2	ΔG <sub>Vp2</sub>			G <sub>Vp3</sub> — G <sub>Vp4</sub>				-1	0	+1	dB		
Intermode gain difference	ΔG <sub>Vp EP-SP</sub>			G <sub>Vp3</sub> — G <sub>Vp1</sub>				1.0	2.0	3.0	dB		
Equivalent input noise voltage	CH1	V <sub>NIN1</sub>	T20A	T10A	After 1.1 MHz LPF $\frac{V_{OUT}}{G_{Vp1,2,3,4}}$	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	ΔV <sub>fp1</sub>	T20A	T10A	V <sub>I</sub> = 38 mVp-p f = 7 MHz $\frac{V_{OUT}}{G_{Vp1,2,3,4}}$ output ratio	Open	0	0	-2.5	+1		dB	
	CH2	ΔV <sub>fp2</sub>	T23A	T10A		Open	0	2.5		-2.5	+1		dB
	CH3	ΔV <sub>fp3</sub>	T27A	T10A		Open	5.0	0		-2.5	+1		dB
	CH4	ΔV <sub>fp4</sub>	T30A	T10A		Open	5.0	2.5		-2.5	+1		dB
Secondary harmonic distortion	CH1	V <sub>HDP1</sub>	T20A	T10A	V <sub>I</sub> = 38 mVp-p f = 4 MHz 8 M component 4 M 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 Output level when tertiary distortion of 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	
Cross-talk SP (Note 1)	CH1	V <sub>CR1</sub>	T23A	T10A	V <sub>I</sub> = 38 mVp-p f = 4 MHz $\frac{V_{OUT}}{G_{Vp1,2}}$	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	
Cross-talk EP (Note 1)	CH3	V <sub>CR3</sub>	T20A	T10A	V <sub>I</sub> = 38 mVp-p f = 4 MHz $\frac{V_{OUT}}{G_{Vp3,4}}$	Open	5.0	0		-40	-35	dB	
			T23A	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	
			T23A	T10A		Open	5.0	2.5		-40	-35	dB	
			T27A	T10A		Open	5.0	2.5		-40	-35	dB	

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Parameter	Symbol	Input	Output	Conditions	T2	T4	T5	min	typ	max	Unit
Output DC offset	$\Delta V_{ODC1}$		T10A	CH1—CH2	Open		0	-100	0	+100	mV
					Open	0	2.5	-100	0	+100	mV
	$\Delta V_{ODC2}$		T10A	CH3—CH4	Open		0	-100	0	+100	mV
					Open	5.0	2.5	-100	0	+100	mV
	$\Delta V_{ODC3}$		T10A	CH1—CH3	Open		0	-100	0	+100	mV
					Open	5.0	0	-100	0	+100	mV
	$\Delta V_{ODC4}$		T10A	CH2—CH4	Open		0	-100	0	+100	mV
					Open	5.0	2.5	-100	0	+100	mV
$\Delta V_{ODC5}$		T10A	CH1—CH4	Open		0	-100	0	+100	mV	
				Open	5.0	2.5	-100	0	+100	mV	
$\Delta V_{ODC6}$		T10A	CH2—CH3	Open		0	-100	0	+100	mV	
				Open	5.0	0	-100	0	+100	mV	
Envelope wave detection output pin voltage	$V_{ENV}$		T8	T8 DC voltage with no input	Open	0	0	0	0.8	1.5	V
Envelope wave detection voltage SP1	$V_{ENVSP1}$	T20A	T8	f = 4 MHz, T10A: Adjusted to 175 mVp-p	Open	0	0	2.1	2.6	3.1	V
Envelope wave detection voltage SP2	$V_{ENVSP2}$	T20A	T8	f = 4 MHz, T10A: Adjusted to 450 mVp-p	Open	0	0	4.5	4.8	5.0	V
Envelope wave detection voltage EP1	$V_{ENVEP1}$	T27A	T8	f = 4 MHz, T10A: Adjusted to 125 mVp-p	Open	5.0	0	2.0	2.5	3.0	V
Envelope wave detection voltage EP2	$V_{ENVEP2}$	T27A	T8	f = 4 MHz, T10A: Adjusted to 350 mVp-p	Open	5.0	0	4.5	4.8	5.0	V
Comparator output voltage 1	$V_{COMP1}$	T20A	T3	f = 4 MHz, $V_I = 38$ mVp-p T3 DC voltage	5.0	0	0		0.4	0.7	V
Comparator output voltage 2	$V_{COMP2}$	T27A	T3	f = 4 MHz, $V_I = 38$ mVp-p T3 DC voltage	5.0	5.0	0	4.5	4.8		V
ON resistance of SW-Tr which is turned ON in PB mode	$R_{PON17}$		P-17	DC difference measured for 1 mA, 2 mA current inflow					4.0	6.0	$\Omega$
	$R_{PON18}$		P-18						4.0	6.0	$\Omega$
ON resistance of SW-Tr which is turned ON in PB mode	$R_{PON21}$		P-21	DC difference measured for 1 mA, 2 mA current inflow	Open	5.0			4.0	6.0	$\Omega$
	$R_{PON24}$		P-24		Open	5.0			4.0	6.0	$\Omega$
	$R_{PON26}$		P-26		Open	0			4.0	6.0	$\Omega$
	$R_{PON29}$		P-29		Open	0			4.0	6.0	$\Omega$
Trick 1 threshold level	TR1-1		T2	Normal → Trick 1	*			3.2		5.0	V
	TR1-2		T2	Trick 1 → Normal	*			1.2		2.8	V
Trick 2 threshold level	TR2-1		T2	Normal → Trick 2	*			0.0		0.8	V
	TR2-2		T2	Trick 2 → 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		T5	Hch → Lch			*	0.0		0.8	V

Note 1: Status where input stage L (8.2  $\mu$ H) is shorted

Note: Because the T4 (HA) control switching timing is synchronized with T6 (H-Sync), a trigger pulse (0 V to 5 V to 0 V) must be input to T6 before measuring each parameter for the LA7416/M.

“\*” represents output pins.

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## Electrical Characteristics at Ta = 25 °C

Parameter	Symbol	Input	Output	Conditions	T13	T4	T5	min	typ	max	Unit
[REC Mode]				T15: 5.0 V T2: Open T6: 5.0 V T7: 5.0 V	REC Adj2	HA	SW30 MUTE				
Current consumption	I <sub>CCP</sub>			Pin 15 current input	Open	0	0	50	55	60	mA
REC AGC Amp output level	V <sub>RSP</sub>	T11A	T21A	f = 4 MHz V <sub>I</sub> = 200 mVp-p	Open	0	0	147	156	165	mVp-p
	V <sub>REP</sub>	T11A	T26A	V <sub>I</sub> = 200 mVp-p	Open	5.0	0	116	123	130	mVp-p
Intermode gain difference	ΔG <sub>VR</sub>			V <sub>RSP</sub> /V <sub>REP</sub>				1.30	2.05	2.80	dB
REC AGC Amp control characteristics 1	ΔV <sub>AGC1-SP</sub>	T11A	T21A	f = 4 MHz, V <sub>I</sub> = 400 mVp-p Output level/ V <sub>RSP</sub> EP ratio	Open	0	0		0.5	1.0	dB
	ΔV <sub>AGC1-EP</sub>	T11A	T26A		Open	5.0	0		0.5	1.0	dB
REC AGC Amp control characteristics 2	ΔV <sub>AGC2-SP</sub>	T11A	T21A	f = 4 MHz, V <sub>I</sub> = 100 mVp-p Output level/ V <sub>RSP</sub> EP ratio	Open	0	0	-1.0	-0.5		dB
	ΔV <sub>AGC2-EP</sub>	T11A	T26A		Open	5.0	0	-1.0	-0.5		dB
REC AGC Amp frequency characteristics (Note 2)	ΔV <sub>FRS</sub>	T11A	T21A	f = 1 M, 7 MHz, V <sub>I</sub> = 200 mVp-p 7 MHz/1 MHz, output ratio	Open	0	0	-4.0	-3.0	-2.0	dB
	ΔV <sub>FRE</sub>	T11A	T26A		Open	5.0	0	-4.0	-3.0	-2.0	dB
REC AGC Amp secondary harmonic level	ΔV <sub>HDRS</sub>	T11A	T21A	f = 4 MHz, V <sub>I</sub> = 200 mVp-p 8 M component	Open	0	0		-45	-40	dB
	ΔV <sub>HDRE</sub>	T11A	T26A	4 M component output ratio	Open	5.0	0		-45	-40	dB
REC AGC Amp maximum output level (Note 3)	ΔV <sub>OMRS</sub>	T11A	T21A	f = 4 MHz, Output level when secondary distortion of the output is -30 dB	Adj.	0	0	20	22		mAp-p
	ΔV <sub>OMRE</sub>	T11A	T26A		Adj.	5.0	0	20	22		mAp-p
REC AGC Amp mute attenuation	ΔV <sub>MRS</sub>	T11A	T21A	f = 4 MHz, V <sub>I</sub> = 200 mVp-p Output level/ V <sub>RSP</sub> EP output ratio	Open	0	5.0		-45	-40	dB
	ΔV <sub>MRE</sub>	T11A	T26A		Open	5.0	5.0		-45	-40	dB
REC AGC Amp mixed modulation relative level	ΔV <sub>CYS</sub>	T10A	T21A	T10A: f = 629 kHz, V <sub>I</sub> = 360 mVp-p T11A: f = 4 MHz, V <sub>I</sub> = 200 mVp-p (4 M±629 k)/4 M output ratio	Open	0	0		-45	-40	dB
	ΔV <sub>CYE</sub>	T11A	T26A		Open	5.0	0		-45	-40	dB
ON resistance of SW-Tr which switches between modes in REC mode	R <sub>RON17</sub>		P-17	DC difference measured for 1 mA, 2 mA current inflow	Open	5.0			4.0	6.0	Ω
	R <sub>RON18</sub>		P-18		Open	0			4.0	6.0	Ω
	R <sub>RON21</sub>		P-21		Open	5.0			4.0	6.0	Ω
	R <sub>RON24</sub>		P-24		Open	5.0			4.0	6.0	Ω
	R <sub>RON26</sub>		P-26		Open	0			4.0	6.0	Ω
	R <sub>RON29</sub>		P-29		Open	0			4.0	6.0	Ω
HA REC threshold level	HAR-1		T4	SP → EP		*		1.8		5.0	V
	HAR-2		T4	EP → SP		*		0.0		1.4	V
REC 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
REC/PB threshold level	SW REC/PB			T7: Control voltage				2.2		5.0	V

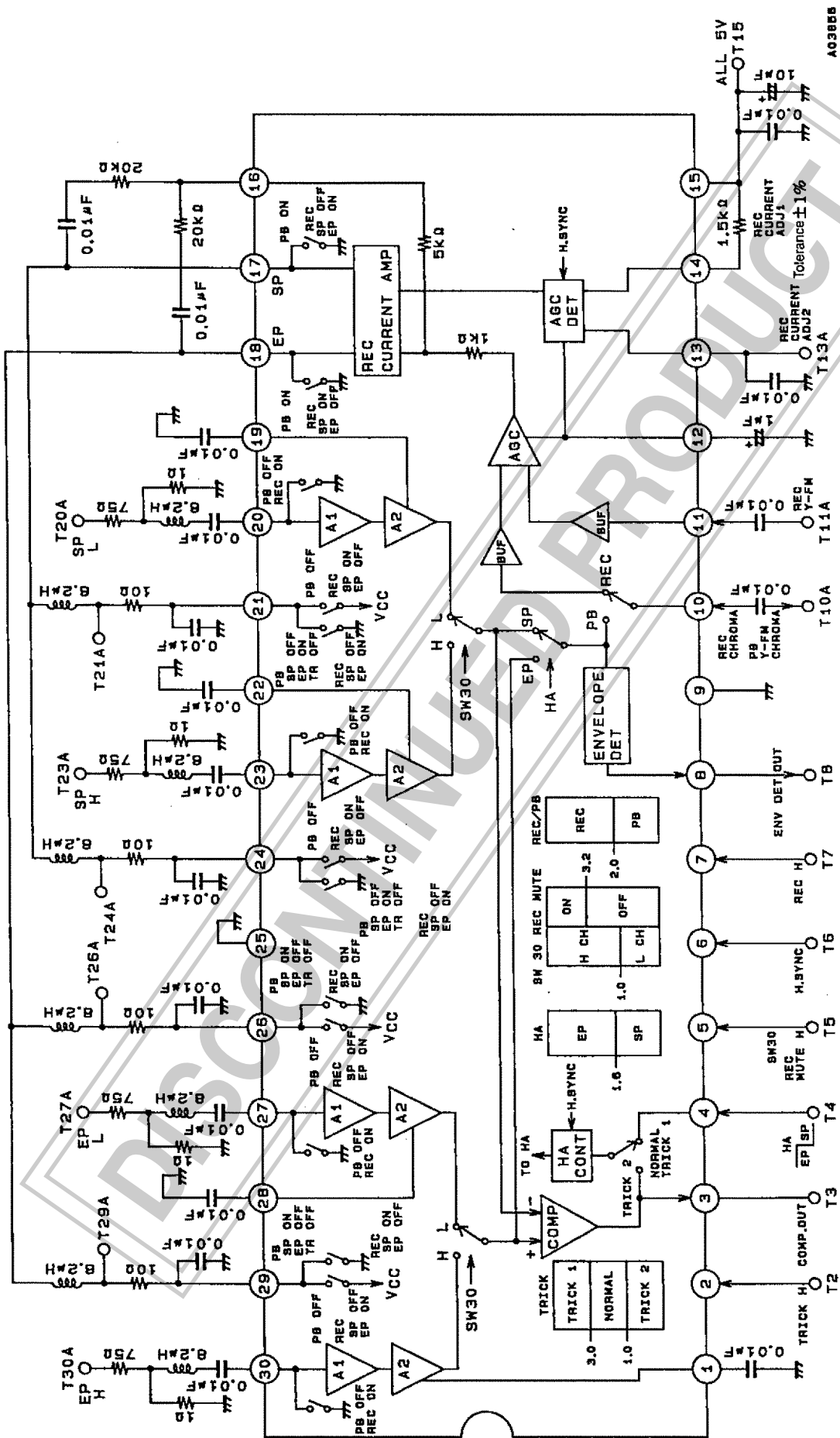
Note 2: Apply approximately 1.8 V DC to the AGC wave detection filter pin (pin 12) and fix the amplifier gain for measurement.

Note 3: Apply DC voltage to T13 (REC CUR. ADJ2) and adjust the output level.

Note: Use a resistor with a tolerance of ± 1.0% between pins 14 and 15.

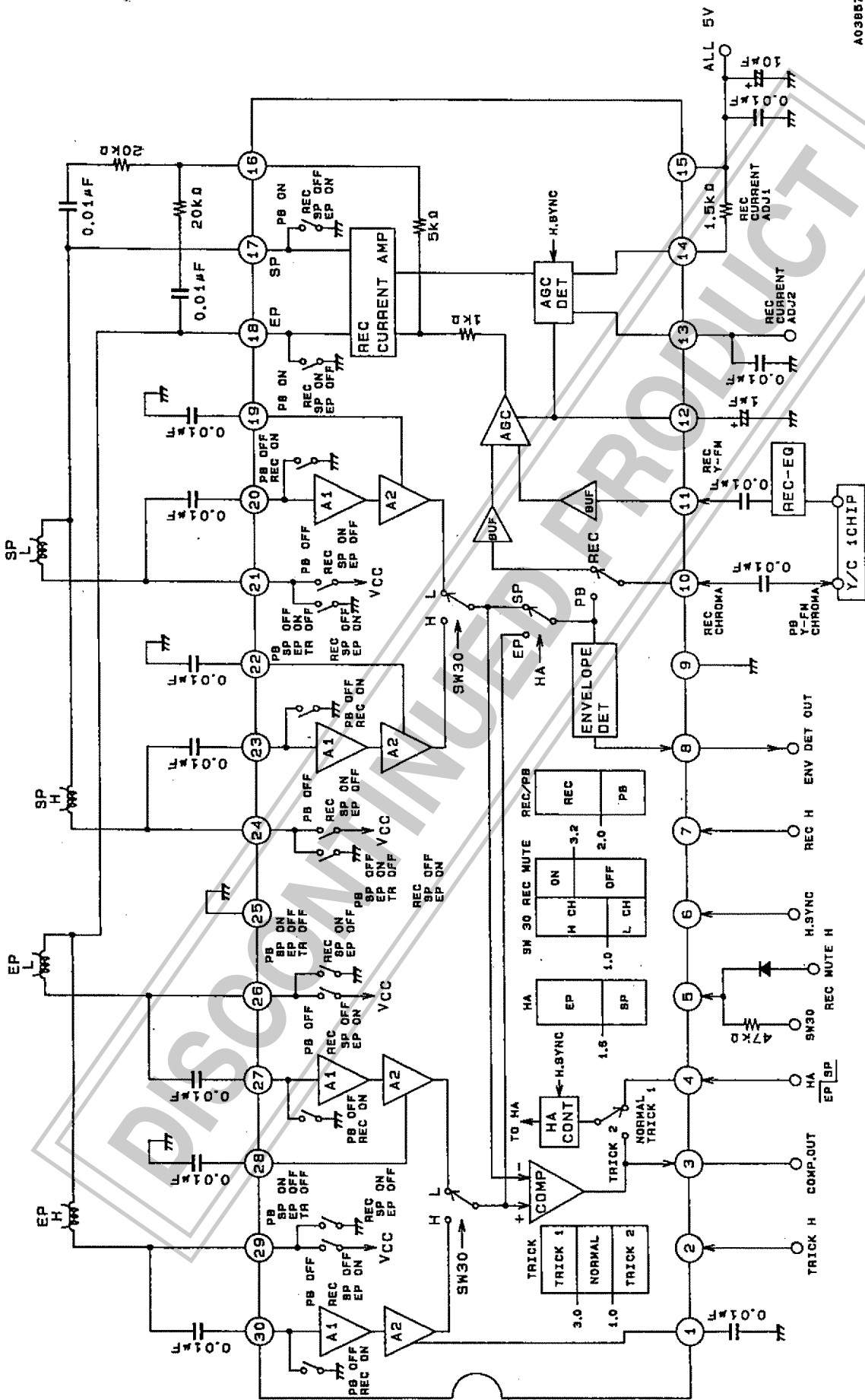
“\*” represents output pins.

Test Circuit Diagram



A03885

Sample Application Circuit



A03857

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