Ordering number: EN *3735

Monolithic Linear IC No.*3735 LA9300M R-DAT Recording, Playback and Equalization Amplifier

Preliminary

OVERVIEW

The LA9300M is a recording, playback and equalization amplifier for R-DAT (Digital Audio Tape) equipment. It incorporates two complete recording/playback amplifiers, equalizers and limiters.

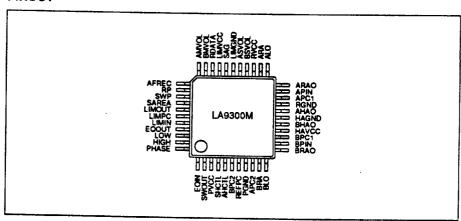
The LA9300M provides an easy interface to digital signal processing (DSP) devices and a low external component count, making it ideal for use as the front-end of a DAT player/recorder.

The LA9300M operates from a single 5 V supply and is available in 44-pin QFPs.

FEATURES

- Two complete recording/playback amplifiers
- PCM equalizer
- Simple interface to DSP devices
- Low external component count
- Internal selection of pilot signal recording current
- Single 5 V supply
- 44-pin QFP

PINOUT



Specifications and information herein are subject to change without notice

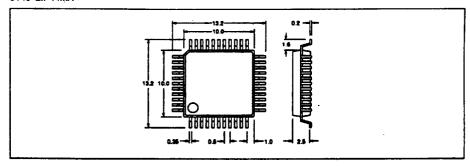
SANYO Electric Co., Ltd. Semiconductor Division atsume Bldg., 18-6, 2-chome, Yushima, Bunkyo-ku, TOKYO 113 JAPAN

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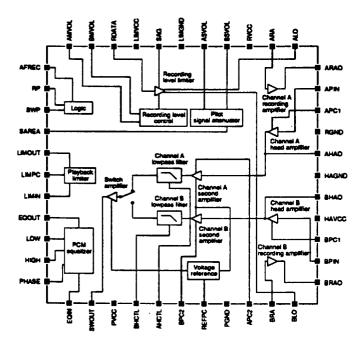
PACKAGE DIMENSIONS

Unit: mm

3148-QIP44MA



BLOCK DIAGRAM



PIN DESCRIPTION

Number	Name	Equivalent circuit	Description
1	EQIN	10 kg 1	PCM equalizer input. Nominal voltage = 3.2 V
2	SWOUT	3 + 0 sac us	Channel A/B switch amplifier output. Emitter follower. Nominal voltage = 2.55 V
3	PVCC		5 V supply for lowpass filter, switch amplifier, equalizer, logic circuits and reference voltage circuit
4	BHCTL		Channel B lowpass filter cutoff frequency adjust. Nominal voltage = 0.75 V
5	AHCTL		Channel A lowpass filter cutoff frequency adjust. Nominal voltage = 0.75 V
6	BPC2	@ 	Channel B second-amplifier bypass capacitor. Nominal voltage = 1.45 V
7	REFPC	⊕ 12 kg	Reference voltage bypass capacitor. Nominal voltage ± 2.5 V
8	PGND		Ground for lowpass filter, switch amplifier, equalizer, logic circuits and reference voltage

Number	Name	Equivalent circuit	Description
9	APC2	• * * *	Channel A second-amplifier bypass capacitor. Nominal voltage = 1.45 V
10	BRA		Channel B recording amplifier input. Nominal voltage = 0.7 V
11	BLO	13 da ma	Channel B recording limiter output. Emitter follower. Nominal voltage = 3.6 V
12	BRAO		Channel B recording amplifier output. Open collector
13	BPIN .	@ 	Channel B head amplifier input. Nominal voltage = 2.3 V
14	BPC1	@#/# (Channel B head amplifier bypass capacitor. Nominal voltage = 1.6 V
15	HAVCC		5 V supply for head amplifiers and second amplifiers
16	BHAO	180 µA	Channel B head amplifier output. Emitter follower. Nominal voltage = 2.95 V
17	HAGND		Ground for head amplifiers and second amplifiers
18	AHAO	ı J	Channel A head amplifier output. Nominal voltage = 2.95 V
19	RGND		Ground for recording amplifiers

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Numbe	r Name	Equivalent circuit	Description
20	APC1	D I I	Channel A head amplifier bypass capacitor. Nominal voltage = 1.6 V
21	APIN	® #	Channel A head amplifier input. Nominal voltage = 2.3 V
22	ARAO		Channel A recording amplifier output
23	ALO	3 0.8 ma	Channel A recording limiter output. Nominal voltage = 3.6 V
24	ARA	*	Channel A recording amplifier input. Nominal voltage = 0.7 V
25	RVCC		5 V supply for recording amplifiers
26	BSVOL	88	Channel B pilot signal attenuation adjust. Nominal voltage = 0.7 V
27	ASVOL	® # # # # # # # # # # # # # # # # # # #	Channel A pilot signal attenuation adjust. Nominal voltage = 0.7 V
28	LIMGND		Ground for playback and recording limiters, volume and pilot signal attenuators
29	SAG	I-7	Recording limiter sag compensation capacitor.

Humber	Herne	Equivalent aircuit	Description .
30	LIMVCC		5 V supply for playback and recording limiters, volume and pilot signal attenuators
31	RDATA		Recording data input
32	BMIVOL	8	Channel B recording amplitude adjust
33	AMVOL	**************************************	Channel A recording amplitude adjust
34	AFREC	S 1000 1 100 100 100 100 100 100 100 100	After-recording mode control pin
35	RP	S = 8000 A 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Recording/playback mode control pin
36	SWP	3000	Channel A/B select input
37	SAREA	3 SMA 131A	Recording current control input

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Number	Herne	Equivalent sircuit	Description
39	LIMOUT	25 mA	Playback limiter output. Emitter follower
39	LIMPC		Playback limiter bypass capacitor. Nominal voltage = 2.5 V
40	LIMIN	## D ******	Playback limiter input. Nominal voltage = 2.6 V
41	EGOUT	(a) # (b) 800 M	PCM equalizer output. Emitter follower. Nominal voltage = 1.7 V
42	LOW		PCM equalizer low-frequency adjust. Nominal voltage = 0.7 V
43	HIGH		PCM equalizer high-frequency adjust. Nominał voltage = 0.7 V
44	PHASE		PCM equalizer phase adjust. Nominal voltage = 0.7 V

SPECIFICATIONS

Absolute Maximum Ratings

Parameter	Symbol .	Rating	Unit
Supply voltage	Voc max	7	V
Power dissipation	Po	500	mW
Operating temperature range	Tong	-25 to 75	deg. C
Storage temperature range	Teep	-40 to 125	deg. C

Recommended Operating Conditions

 $T_a = 25$ deg. C

Parameter	Symbol	Rating	Unit
Supply voltage	Vœ	5	٧
Supply voltage range	Vœ	4.75 to 5.25	V

Electrical Characteristics

 V_{∞} = 5.0 V, T_x = 25 deg. C

Parameter	Symbol	Condition		Rating		Unit	
	- Oyliada	Constign	min	typ	mex	Unk	
LOW-level input voltage	ViL		0	-	0.2V _{CC}	٧	
HIGH-level input voltage	V _{IH}		0.8V _{CC}	-	Vcc + 0.2	٧	
Playback-mode supply current	lcc	SWP is LOW, SAREA is LOW, S4a, S5c	21	35	49	mA	
Recording-mode supply current excluding recording amplifier bias current	loca	SWP is LOW, SAREA is LOW, S6a, S7a, S2a, S3a	11	18	25	mA	
Channel A recording amplifier bias current	Iga	SAREA is LOW, S7b	18.2	19.9	21.7	mA	
Channel B recording amplifier bias current	lpg	SAREA is LOW, S2b	18.2	19.9	21.7	mA	
		SAREA is LOW, f = 1 MHz, duty cycle = 50%, Vsz = Vs3 = 2.0 V, S6a, S7b, S3a, S2b, S8 closed	100	120	144	mV _{p−p}	
Channels A and B limiter output amplitude	Val	SAREA is LOW, f = 1 MHz, duty cycle = 50%, V ₃₂ = V ₃₃ = 2.5 V, S6a = S7b, S3a, S2b, S8 closed	308	370	438		
		SAREA is LOW, 1 = 1 MHz, duty cycle = 50%, V ₃₂ = V ₃₃ = 2.5 V, S6a, S7b, S3a, S2b, S8 closed	631	750	894		

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Parameter	Symbol	Condition		Ruting			
			min	typ	mex	Unit	
		SAREA is HIGH. 1 = 1 MHz, duty cycle = 50%, V ₃₂ = V ₃₃ = 2.2 V, S6a, S7b, S3a, S2b, S closed, R26 = R27 = 11 kΩ	78	100	123		
Channets A and B limiter output amplitude	Va.	SAREA is HIGH, 1 = 1 MHz, duty cycle = 50%, Vz = Vz = 2.2 V, S6a, S7b, S3a, S2b, S closed, R26 = R27 = 68 kΩ	289	370	455	55 mV _{p-9}	
		SAREA is HIGH, f = 1 MHz, duty cycle = 50%, Vs ₂ = Vs ₃ = 2.2 V, S6a, S7b, S3a, S2b, S8 closed R26 = R27 = 230 kΩ	378	485	596		
Channels A and B recording duty cycle	Duty ₁	SAREA is LOW, f = 1 MHz, duty cycle = 50%, Vsz = Vss = 2.2 V, S6a, S7b, S3a, S2b, S8 closed	47	50	53	*	
Channels A and B recording amplifier output level	Vo	f = 1 MHz, V _{inRC2} = 300 mV _{p-p} sine wave, S6b, S7a, S3b, S2a	1.25	1.40	1.57		
		f = 10 MHz, V_{inRC2} = 300 mV _{p-p} sine wave, S6b, S7a, S3b, S2a	0.88	1.10	1.40	Vpp	
Channels A and B recording Implifier second-harmonic listortion	HDat	f = 5 MHz, $V_{inRC2} = 300$ m V_{p-p} sine wave, S6b, S7a, S3b, S2a	-	-42	-37	dB	
hannel A playback amplifier utput level	VPA	f=1 MHz, $V_{mPB}=20.6$ m V_{p-p} sine wave, $R_4=R_5=2$ k Ω , S4a, $S5b$	208	330	523	mV _{p∗p}	
hannel B playback amplifier utput level	V _{PB}	f=1 MHz, $V_{nPB}=20.6$ mV _{p-p} sine wave, $R_4=R_5=2$ k Ω , S4b, S5c	208	330	523	mV _{p−p}	
hannel A playback amplifier cond-harmonic distortion	HD ₈₂	f=1 MHz, $V_{nPB}=20.6$ mV _{P-p} sine wave, R ₄ = R ₅ = 2 k Ω , S4a, S5b	-	50	-37	dB	
nannel B playback amplifier cond-harmonic distortion		f = 1 MHz, $V_{mPB} = 20.6$ m V_{p-p} sine wave, $R_4 = R_5 = 2$ k Ω , S4b, S5c	-	-50	-37	dB	

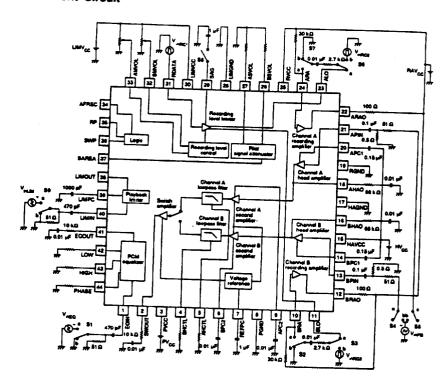
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Parameter	Symbol	Condition		Unit			
retentour	ohnee	Congaign	min	typ	Mėz		
Channel A playback amplifier frequency characteristic	Fc	f=10 MHz/1 MHz, $V_{nMg}=20.6$ mV _{p-p} sine wave, $R_4=R_5=2$ kQ, S4a, S5b	-5.5	-1.5	0.5	dB	
Channel 8 playback amplifier frequency characteristic	Fa	f = 10 MHz/1 MHz, V _{rang} = 20.6 mV _{p-p} sine weve, R ₄ = R ₅ = 2 kΩ, S4b, S5c	-5.5	-1.5	0.5	₫₿	
Equalizer frequency characteristic		$f=1.5$ MHz, $V_{\text{MEO}}=200$ mV _{P-P} sine wave, Re2-44 = 7.5 kQ, S1a, RP is LOW, SWP is LOW, SAREA is LOW.	-4.9	-4.0	-3.3	dB	
Edwards Inditione's Civilaceise	Faso	1 = 4.7 MHz, V_{mEQ} = 200 mV _{P-P} sine wave, $R_{\text{S}-\text{44}}$ = 7.5 kΩ, S1a, RP is LOW, SWP is LOW, SAREA is LOW.	3.0	5.2	7,4	9 GB	
Equalizer phase response		ISTA, RP IS LOW, SWP IS LOW, SAREA IS LOW.		197			
	CA	$f=4.7$ MHz, $V_{\text{inEQ}}=200$ mV $_{p-p}$ sine wave, Ru ₂₋₄₄ = 7.5 kQ, S1a, RP is LOW, SWP is LOW, SAREA is LOW.	102	52	-1		
Playback limiter duty cycle	Duty ₂	1 = 5 MHz, V _{inUM} = 100 mV _{Pp} sine wave, S9a, RP is LOW, SWP is LOW, SAREA is LOW.	47	52	54	%	

Note

Smn indicates a switch position where m is the switch number, 1 to 8, and n is the switch position, a, b or c.

Measurement Circuit



FUNCTIONAL DESCRIPTION

Recording

Recording signal amplitude control

This circuit comprises a recording limiter, an amplitude controller and a pilot attenuator signal. It adjusts the amplitude of the recording signal produced by a digital signal processor (DSP).

The amplitude is adjusted by the voltage on AMVOL for channel A, and on BMVOL, for channel B. The control voltage range is 1.7 to 2.8 V. As AMVOL and BMVOL both have internal 100 k Ω resistors to ground, variable resistors connected to these pins should have a value less than 100 k Ω . The data signal amplitude is 370 mV_{PP} variable within ±5 dB.

The pilot signal amplitude is independently adjusted by the resistor connected to ASVOL for channel A. and to BSVOL, for channel B. The pilot signal is attenuated when SAREA is HIGH. The amplitude of the pilot signal is attenuated by up to 8 dB below the amplitude of the data signal.

SAG is used to compensate for the differentiation effect of the head coil. In particular, the pilot signal recording current is a differentiated waveform. SAG adjusts the phase of the pilot signal's fundamental

Recording amplifiers

The signals from the variable limiter are voltage-to-current converted, and then amplified by the recording amplifiers. Current gain is approximately 43 dB.

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Playback

Head amplifiers

These amplify the signal from the tape heads. Voltage gain is approximately 42 dB.

Second amplifiers

These further amplify the output from the head amplifiers. Voltage gain is approximately 12 dB.

Playback lowpass filters

These modify the frequency characteristics of the playback signal. The filter response is controlled by the resistor connected to AHCTL for channel A, and to BHCLT, for channel B. These resistors should be in the range 2 to 30 k Ω .

SW amplifier

This buffers the signal selected from the lowpass filter outputs. Channel A is selected when SWP is LOW, and channel B, when SWP is HIGH.

PCM equalizer

This equalizes the output signal to compensate for the distortion introduced by the recording process. The equalization characteristics are controlled by external resistors connected to LOW, HIGH, and PHASE (pins 42, 43 and 44, respectively). These resistors should be in the range 2 to 30 $k\Omega$.

Piayback limiter

This shapes the PCM equalizer output into a rectangular waveform.

OPERATING MODES

			Mode co	introl pins	1			Recording-level	
Mode	Channel	AFREC	RP	SWP	SAREA	Playback amplifiers	PCM equalizer and playback limiters	limitors, amplitude control and recording amplifiers	Pilot atlenuator
Playback	A	L	L	L	L	,	1	×	×
,	В	L	L	, н	L	1	1	×	×
Recording	A	L	н	L	L/H	×	×	1	×Id
. wooding	В	L	H	Н	L/H	×	×	1	×I.f
After recording	A	н	L	L	L	-	,	×	×
(playback)	В	Н	L	Н	ı	1	1	×	×
playback) After recording	A	н	Н	ī	L/H	×	1	,	×II
(recording)	В	Н	Н	Н	L/H	×		,	×II

Notes

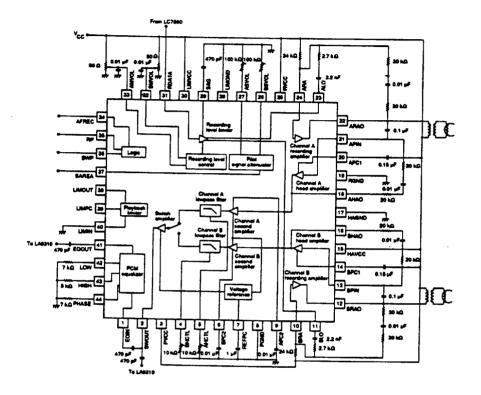
✓ = operating, × = halted

weans halted when SAREA is LOW, and operating, when SAREA is HIGH.

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TYPICAL APPLICATION



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