



LC7536LHS

High-Voltage, Two-Channel Electronic Attenuator

Overview

The LC7536LHS is a two-channel electronic attenuator for volume, balance and loudness controls in stereo audio applications.

The LC7536LHS reads data from a three-line serial bus to control attenuation in 1 dB steps over an 80 dB range, up to a maximum of 96 dB. It features a center tap at 20 dB attenuation for a loudness control using a minimum of external components. A device select pin allows two devices to be connected to the serial bus.

The LC7536LHS operates from 5 V and 10 V supplies and is available in 30-pin DIPs.

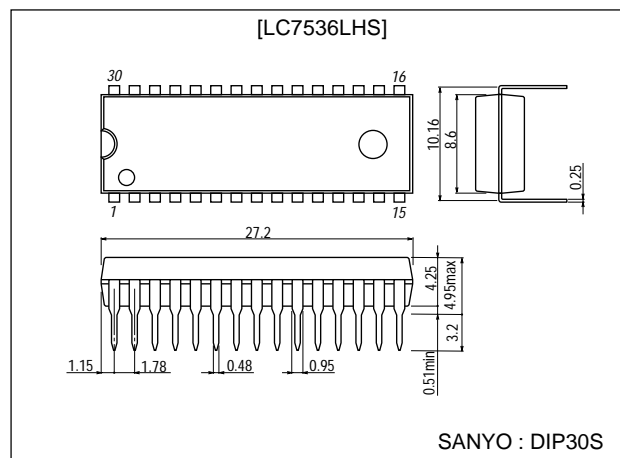
Features

- Three-line serial control.
- Two device select.
- Tap at 20 dB attenuation for a loudness control.
- 80 dB attenuation range adjustable in 1 dB steps.
- 96 dB maximum attenuation.
- 75 dB crosstalk rejection.
- 0.022% total harmonic distortion.
- 47k Ω input impedance.
- 5 V and 10 V supplies.
- 30-pin DIP.

Package Dimensions

unit:mm

3061-DIP30S



Specifications

Absolute Maximum Ratings at $T_a=25^{\circ}\text{C}$, $V_{SS}=0\text{V}$, $V_{EE}=0\text{V}$

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	$V_{DD\text{ max}}$		0 to 12	V
	$V_{CC\text{ max}}$		0 to 7	
CLK, DI and CE input voltage range	V_{I1}		0 to $V_{CC}+0.3$	V
Analog input voltage range	V_{I2}		$V_{EE}-0.3$ to $V_{DD}+0.3$	V
Select pin input voltage range	V_{I3}		$V_{CC}-0.3$ to $V_{DD}+0.3$	V
Allowable power dissipation	$P_d\text{ max}$	$T_a \leq 85^{\circ}\text{C}$	250	mW
Operating temperature range	T_{opr}		-40 to +85	$^{\circ}\text{C}$
Storage temperature range	T_{stg}		-50 to +125	$^{\circ}\text{C}$

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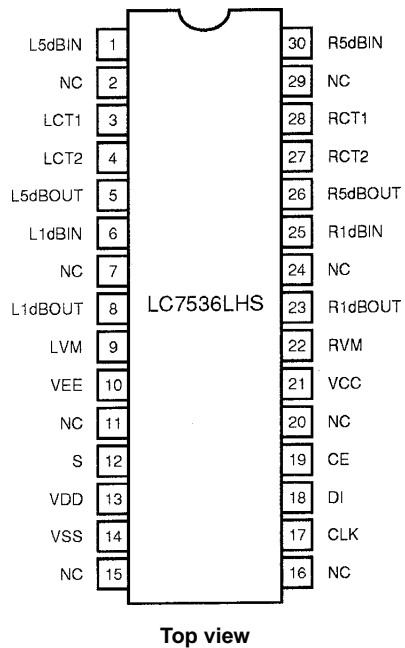
Recommended Operating Conditions at Ta = 25°C, VSS = 0 V, VEE = 0 V

Parameter	Symbol	Conditions	Ratings	Unit
Analog supply voltage	VDD		VCC+3.2 to 10.0	V
Logic supply voltage	VCC		5	V
Logic supply voltage	VCC		3.6 to 5.5	V

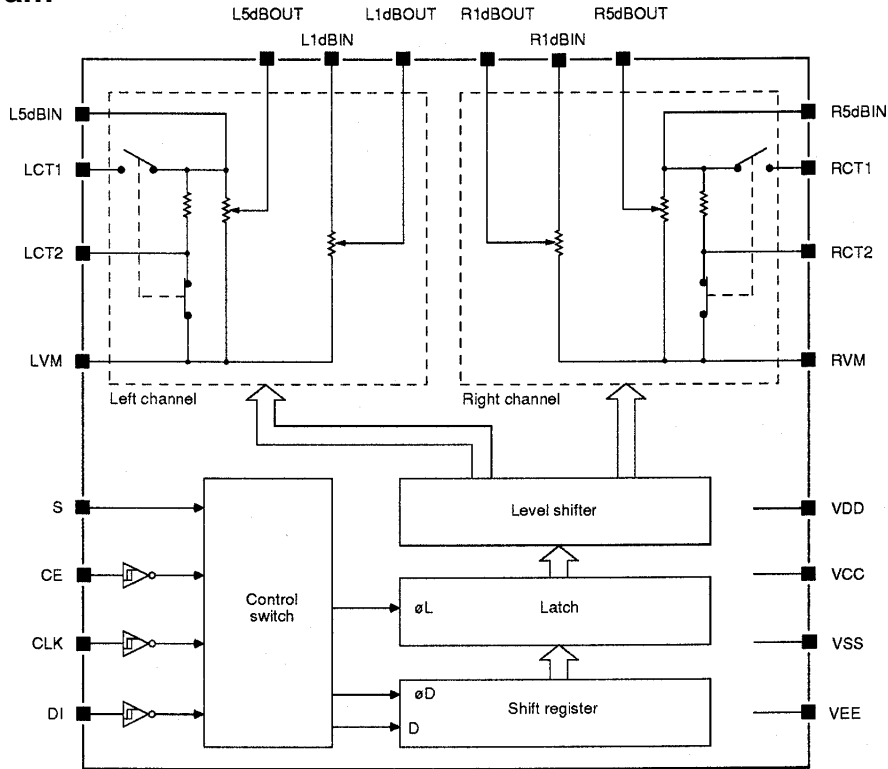
Electrical Characteristics at Ta = 25°C, VCC = 5 V, VDD = 10 V, VEE = 0 V, VSS = 0 V

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Supply current	IDD				1	mA
	ICC				1	
Serial bus HIGH-level input voltage	VIH1		0.8VCC		VCC	V
Select pin HIGH-level input voltage	VIH2		0.8× (VDD -VCC) +VCC		VDD	V
Serial bus LOW-level input voltage	VIL1		VSS		0.2VCC	V
Select pin LOW-level input voltage	VIL2		VCC		0.2× (VDD -VCC) +VCC	V
Input voltage	VIN		VEE		VDD	Vp-P
Input pulsewidth	tΦW		20			μs
Setup time	tsetup		20			μs
Hold time	thold		20			μs
Operating frequency	fopg				25	kHz
Output leakage current	IOFF	Analog switches OFF	-10		+10	μA
Total harmonic distortion	THD	VIN=0.3V, f=1kHz, VDD-VEE=10V, VR=VR(max)		0.022		%
Crosstalk rejection	Cr	f=20kHz, VIN=1V	60	75		dB
Maximum attenuation	V0	f=20kHz, VIN=1V		96		dB

Pin Assignment



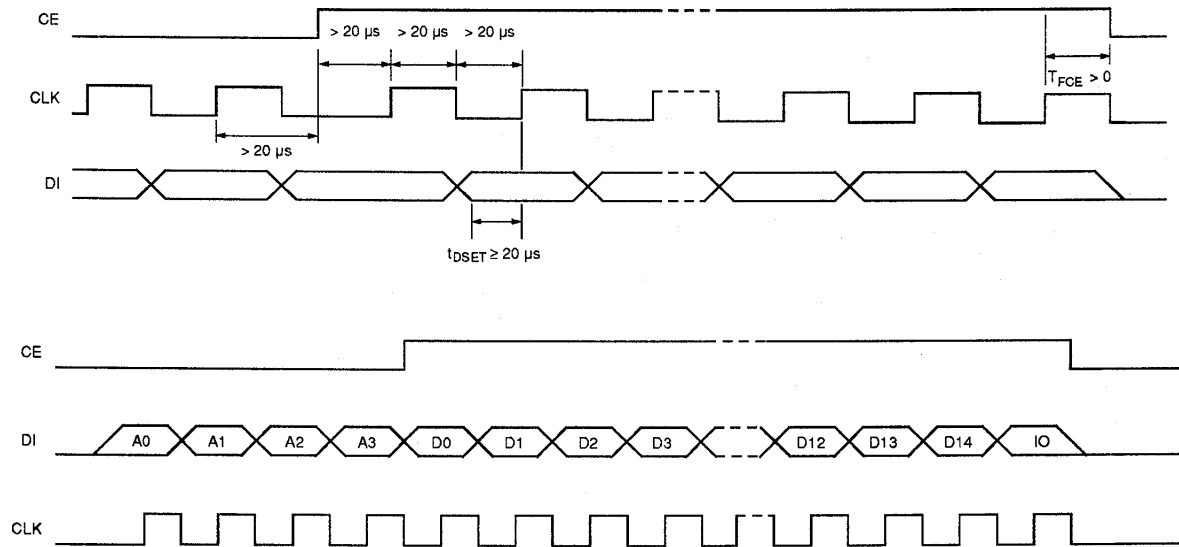
Block Diagram



Pin Description

Number	Name	Description
1	L5dBIN	Left-channel 5 dB attenuaiton step input. Low-impedance drive. 75 kΩ total resistance.
2	NC	No connection
3	LCT1	Left-channel loudness compensation inputs.
4	LCT2	
5	L5dBOUT	Left-channel 5 dB attenuaiton step output. Approximately 1 MΩ load resistance.
6	L1dBIN	Left-channel 1 dB attenuaiton step input. Low-impedance drive.
7	NC	No connection
8	L1dBOUT	Left-channel 1 dB attenuaiton step output. 47 kΩ to 1 MΩ load resistance.
9	LVM	Left-channel volume control common. Normally connected to ground.
10	VEE	Ground
11	NC	No connection
12	S	Address select input.
13	VDD	10 V supply
14	VSS	Ground
15	NC	No connection
16	NC	
17	CLK	Clock input.
18	D1	Serial data input.
19	CE	Chip enable input.
20	NC	No connection
21	VCC	5 V supply
22	RVM	Right-channel volume control common. Normally connected to ground.
23	R1dBOUT	Right-channel 1 dB attenuaiton step otput. 47 kΩ to 1 MΩ load resistance.
24	NC	No connection
25	R1dBIN	Right-channel 1 dB attenuaiton step input. Low-impedance drive.
26	R5dBOUT	Right-channel 5 dB attenuaiton step output. Approximately 1 MΩ load resistance.
27	RCT2	Right-channel loudness compensation inputs.
28	RCT1	
29	NC	No connection
30	R5dBIN	Right-channel 5 dB attenuaiton step input. Low-impedance drive. 75 kΩ total resistance.

Timing



Functional Description

Data Control

Data is clocked into a 20-bit shift register. When 20 bits have been received, the data is latched and then passed to a level shifter.

Data Format

The 20-bit data word comprises a 4-bit address code, two 4-bit 5 dB attenuation step selectors, two 3-bit 1 dB attenuation step selectors and a loudness control ON/OFF bit as shown in figure 1.

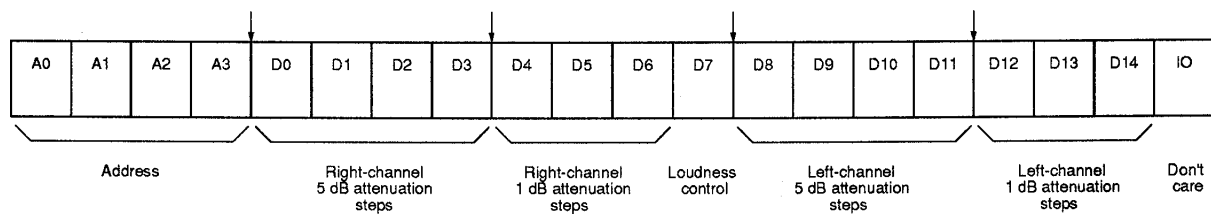


Figure 1. Data format

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The voltage on the select input determines the address of the device as shown in table 1.

Table 1. Address codes

Select pin	A0	A1	A2	A3
V _{DD}	1	0	0	1
V _{CC}	0	0	0	1

Data bits D0 to D3 select the right-channel attenuation in 5 dB steps as shown in table 2. Similarly, bits D8 to D11 select the left-channel attenuation in 5 dB steps.

Table 2. Right-channel 5 dB steps

Attenuation(dB)	D0	D1	D2	D3
0	1	1	1	1
5	0	1	1	1
10	1	0	1	1
15	0	0	1	1
20	1	1	0	1
25	0	1	0	1
30	1	0	0	1
35	0	0	0	1
40	1	1	1	0
45	0	1	1	0
50	1	0	1	0
55	0	0	1	0
60	1	1	0	0
65	0	1	0	0
70	1	0	0	0
75	0	0	0	0

Data bits D4 to D6 select the right-channel attenuation in 1 dB steps as shown in table 3. Similarly, bits D12 to D14 select the left-channel attenuation in 1 dB steps.

Table 3. Right-channel 1 dB steps

Attenuation(dB)	D4	D5	D6
0	0	1	1
1	1	0	1
2	0	0	1
3	1	1	0
4	0	1	0
∞	0	0	0

Data bits D7 selects loudness control. When D7 is 1, loudness control is ON, and when 0, loudness control is OFF.

Audio Signal

The right-channel audio input signal is input on R5dBIN(5 dB attenuation steps). The output, R5dBout, is fed back to R1dBIN (1 dB attenuation steps). The right-channel audio output is on R1dBOUT. The left-channel audio signal flow is identical.

Typical Application

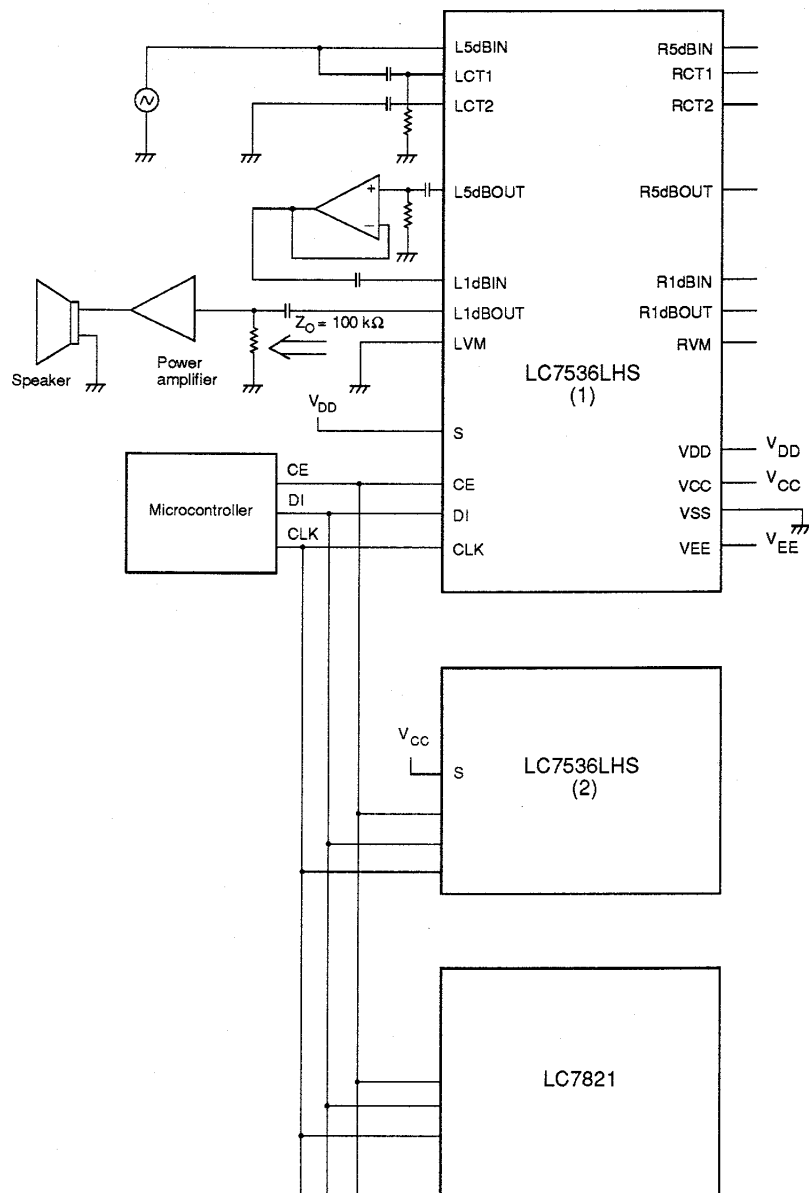


Figure 2. Typical application

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