

**LC75344M****Two-Channel Electronic Volume Control System****Overview**

The LC75344M is a two-channel electronic volume control IC that is controlled by data input over a serial interface.

**Functions**

- Volume control: 0 dB to -50 dB in 1 dB steps, -52 dB to -78 dB in 2 dB steps, and  $-\infty$ , for a total of 66 positions.

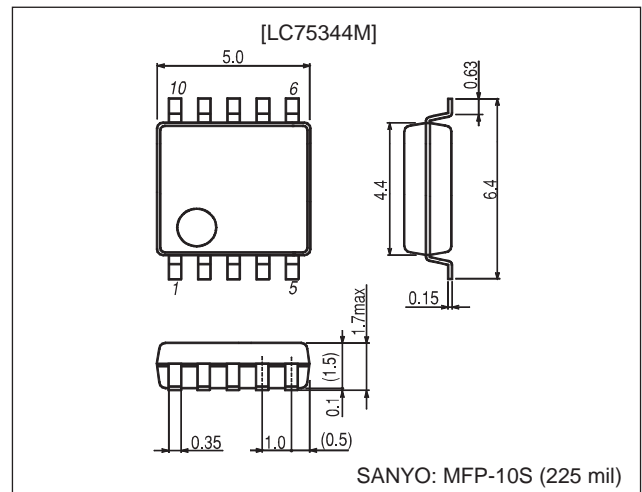
A balance function can be implemented by controlling the left and right channels independently.

**Features**

- Built-in buffer amplifiers minimize the number of external components required.
- Fabricated in a silicon gate CMOS process to minimize the switching noise generated by internal switches.
- Built-in reference voltage generation circuit for the analog ground level.
- All settings are controlled by data input over a serial interface that conforms to the CCB specifications.

**Package Dimensions**

unit: mm

**3086B-MFP10S**

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**SANYO Electric Co.,Ltd. Semiconductor Company**

TOKYO OFFICE Tokyo Bldg., 1-10, 1 Chome, Ueno, Taito-ku, TOKYO, 110-8534 JAPAN

## LC75344M

### Specifications

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

Parameter	Symbol	Pin Name	Conditions	Ratings	Unit
Maximum supply voltage	$V_{DD\text{ max}}$	$V_{DD}$		11	V
Maximum input voltage	$V_{IN\text{ max}}$	CE, DI, CL		-0.3 to +11	V
		LIN, RIN		$V_{SS} - 0.3$ to $V_{DD} + 0.3$	
Allowable power dissipation	$P_d\text{ max}$		$T_a \leq 75^\circ\text{C}$ *1: When mounted on a PCB.	300	mW
Operating temperature	$T_{opr}$			-30 to +75	$^\circ\text{C}$
Storage temperature	$T_{stg}$			-40 to +125	$^\circ\text{C}$

Note : \*1 114.3 × 76.1 × 1.6mm glass epoxy board

#### Allowable Operating Ranges at $T_a = -30$ to $+75^\circ\text{C}$ , $V_{SS} = 0\text{ V}$

Parameter	Symbol	Pin Name	Conditions	Ratings			Unit
				min	typ	max	
Supply voltage	$V_{DD}$	$V_{DD}$		4.5		10	V
Input high-level voltage	$V_{IH}$	CL, DI, CE		2.0		10	V
Input low-level voltage	$V_{IL}$	CL, DI, CE	$7.5 \leq V_{DD} \leq 10$	$V_{SS}$		0.8	V
			$4.5 \leq V_{DD} < 7.5$	$V_{SS}$		0.3	
Input voltage amplitude	$V_{IN}$	LIN, RIN		$V_{SS}$		$V_{DD}$	Vp-p
Input pulse width	$t_{\theta W}$	CL		1			$\mu\text{s}$
Setup time	$t_{setup}$	CL, DI, CE		1			$\mu\text{s}$
Hold time	$t_{hold}$	CL, DI, CE		1			$\mu\text{s}$
Operating frequency	$f_{opg}$	CL				500	kHz

#### Electrical Characteristics at $T_a = 25^\circ\text{C}$ , $V_{DD} = 9\text{ V}$ , $V_{SS} = 0\text{ V}$

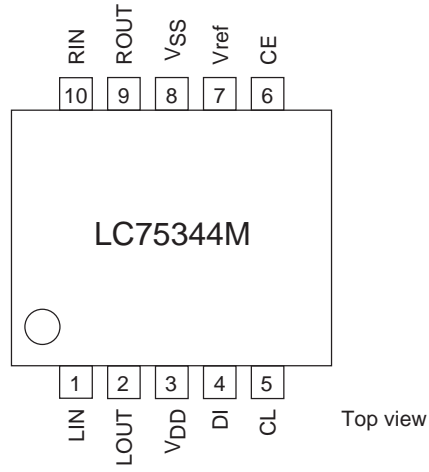
Parameter	Symbol	Pin Name	Conditions	Ratings			Unit
				min	typ	max	
Input resistance	$R_{in}$	LIN, RIN			50		k $\Omega$

#### Overall Characteristics

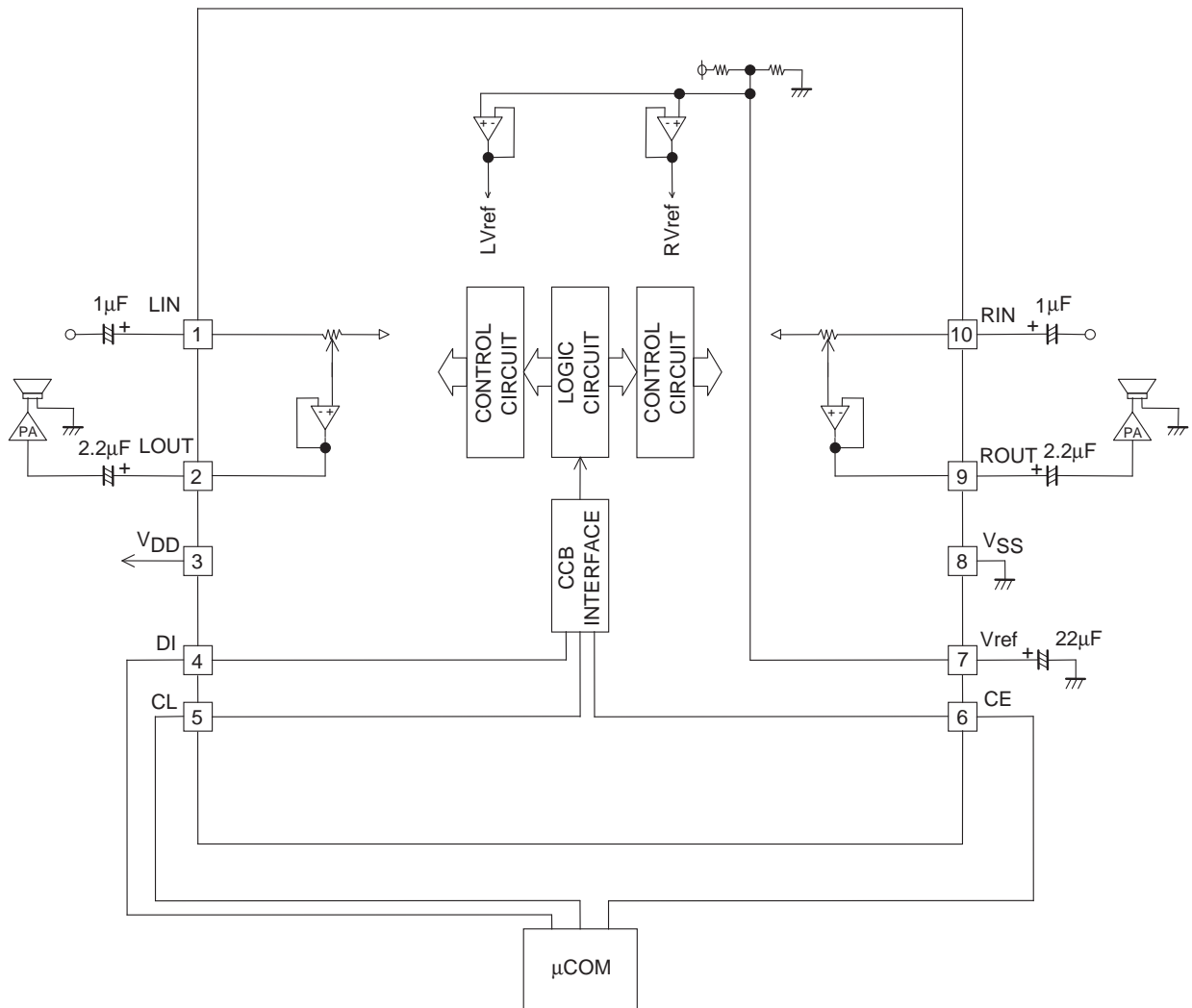
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Total harmonic distortion	THD	$V_{IN} = 1\text{ V}_{rms}$ , $f = 1\text{ kHz}$ With all settings flat overall		0.002	0.01	%
		$V_{IN} = 1\text{ V}_{rms}$ , $f = 20\text{ kHz}$ With all settings flat overall		0.003		
Crosstalk	CT	$V_{IN} = 1\text{ V}_{rms}$ , $f = 1\text{ kHz}$ , $R_g = 1\text{ k}\Omega$ With all settings flat overall	90			dB
Output noise voltage	$V_N$	80 kHz L.P.F., $R_g = 1\text{ k}\Omega$ With all settings flat overall		6.0		$\mu\text{V}$
Maximum attenuation	$V_{omin}$	$V_{IN} = 1\text{ V}_{rms}$ , $f = 1\text{ kHz}$ With all settings flat overall		-92		dB
Current drain	$I_{DD}$	$V_{DD} - V_{SS} = +9\text{ V}$		12		mA
Input high-level current	$I_{IH}$	CL, DI, CE: $V_{IN} = 10\text{ V}$			10	$\mu\text{A}$
Input low-level current	$I_{IL}$	CL, DI, CE: $V_{IN} = 0\text{ V}$	-10			$\mu\text{A}$

# LC75344M

## Pin Assignment

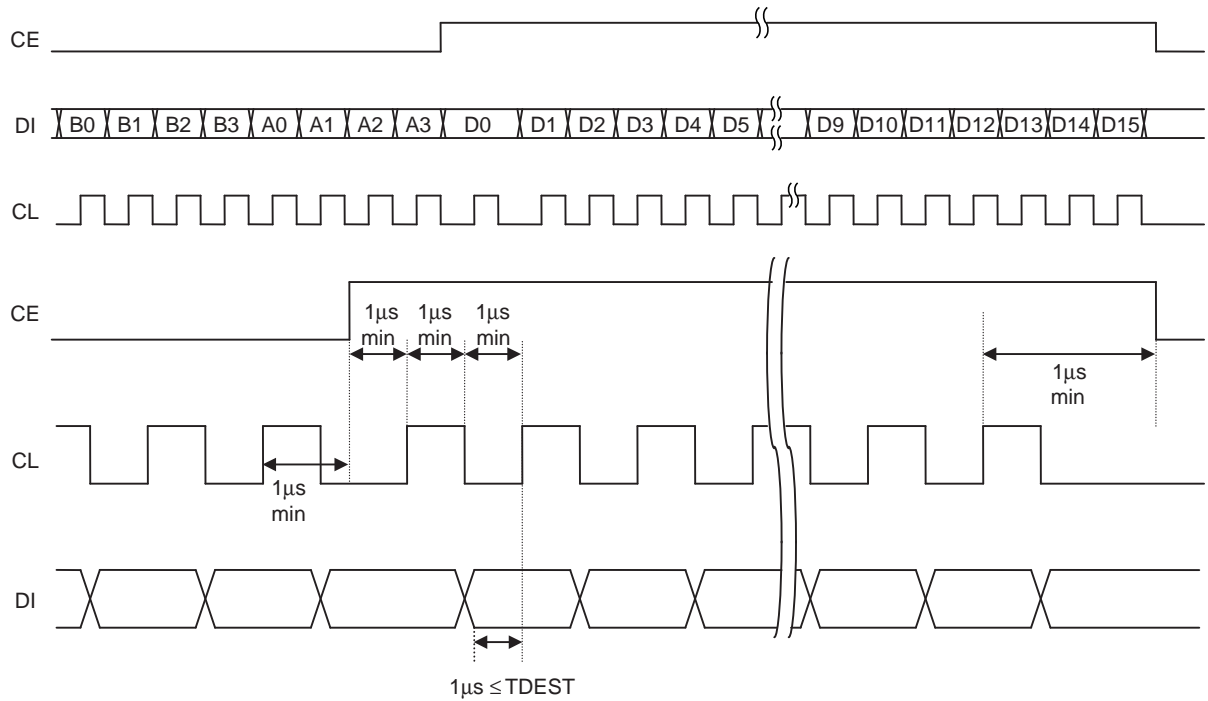


## Equivalent Circuit



**Control System Timing and Data Format**

The LC75344M is controlled by inputting the stipulated data serially to the CL, DI, and CE pins. The data consists of a total of 24 bits, of which 8 bits are the address and 16 bits are the data.



• Address Code (B0 to A3)

The data has an 8-bit address field, and conforms to the Sanyo CCB serial bus specifications.

Address code (LSB)

B0	B1	B2	B3	A0	A1	A2	A3
0	0	0	1	0	0	0	1

(88HEX)

## LC75344M

- Control Code Allocations

Volume control

D0	D1	D2	D3	D4	D5	D6	D7	Operation
0	0	0	0	0	0	0	0	0dB
1	0	0	0	0	0	0	0	-1dB
0	1	0	0	0	0	0	0	-2dB
1	1	0	0	0	0	0	0	-3dB
0	0	1	0	0	0	0	0	-4dB
1	0	1	0	0	0	0	0	-5dB
0	1	1	0	0	0	0	0	-6dB
1	1	1	0	0	0	0	0	-7dB
0	0	0	1	0	0	0	0	-8dB
1	0	0	1	0	0	0	0	-9dB
0	1	0	1	0	0	0	0	-10dB
1	1	0	1	0	0	0	0	-11dB
0	0	1	1	0	0	0	0	-12dB
1	0	1	1	0	0	0	0	-13dB
0	1	1	1	0	0	0	0	-14dB
1	1	1	1	0	0	0	0	-15dB
0	0	0	0	1	0	0	0	-16dB
1	0	0	0	1	0	0	0	-17dB
0	1	0	0	1	0	0	0	-18dB
1	1	0	0	1	0	0	0	-19dB
0	0	1	0	1	0	0	0	-20dB
1	0	1	0	1	0	0	0	-21dB
0	1	1	0	1	0	0	0	-22dB
1	1	1	0	1	0	0	0	-23dB
0	0	0	1	1	0	0	0	-24dB
1	0	0	1	1	0	0	0	-25dB
0	1	0	1	1	0	0	0	-26dB
1	1	0	1	1	0	0	0	-27dB
0	0	1	1	1	0	0	0	-28dB
1	0	1	1	1	0	0	0	-29dB
0	1	1	1	1	0	0	0	-30dB
1	1	1	1	1	0	0	0	-31dB
0	0	0	0	0	1	0	0	-32dB
1	0	0	0	0	1	0	0	-33dB
0	1	0	0	0	1	0	0	-34dB
1	1	0	0	0	1	0	0	-35dB
0	0	1	0	0	1	0	0	-36dB
1	0	1	0	0	1	0	0	-37dB
0	1	1	0	0	1	0	0	-38dB
1	1	1	0	0	1	0	0	-39dB
0	0	0	1	0	1	0	0	-40dB

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### Volume control

D0	D1	D2	D3	D4	D5	D6	D7	Operation
1	0	0	1	0	1	0	0	-41dB
0	1	0	1	0	1	0	0	-42dB
1	1	0	1	0	1	0	0	-43dB
0	0	1	1	0	1	0	0	-44dB
1	0	1	1	0	1	0	0	-45dB
0	1	1	1	0	1	0	0	-46dB
1	1	1	1	0	1	0	0	-47dB
0	0	0	0	1	1	0	0	-48dB
1	0	0	0	1	1	0	0	-49dB
0	1	0	0	1	1	0	0	-50dB
0	0	1	0	1	1	0	0	-52dB
0	1	1	0	1	1	0	0	-54dB
0	0	0	1	1	1	0	0	-56dB
0	1	0	1	1	1	0	0	-58dB
0	0	1	1	1	1	0	0	-60dB
0	1	1	1	1	1	0	0	-62dB
0	0	0	0	0	0	1	0	-64dB
0	1	0	0	0	0	1	0	-66dB
0	0	1	0	0	0	1	0	-68dB
0	1	1	0	0	0	1	0	-70dB
0	0	0	1	0	0	1	0	-72dB
0	1	0	1	0	0	1	0	-74dB
0	0	1	1	0	0	1	0	-76dB
0	1	1	1	0	0	1	0	-78dB
0	0	0	0	1	0	1	0	-∞

### Channel selection

D8	D9	Operation
1	0	RCH
0	1	LCH
1	1	Left and right channels together

### Test mode

D10	D11	D12	D13	D14	D15	Operation
0	0	0	0	0	0	
These bits specify the IC test mode. They must be set to zero for normal operation.						

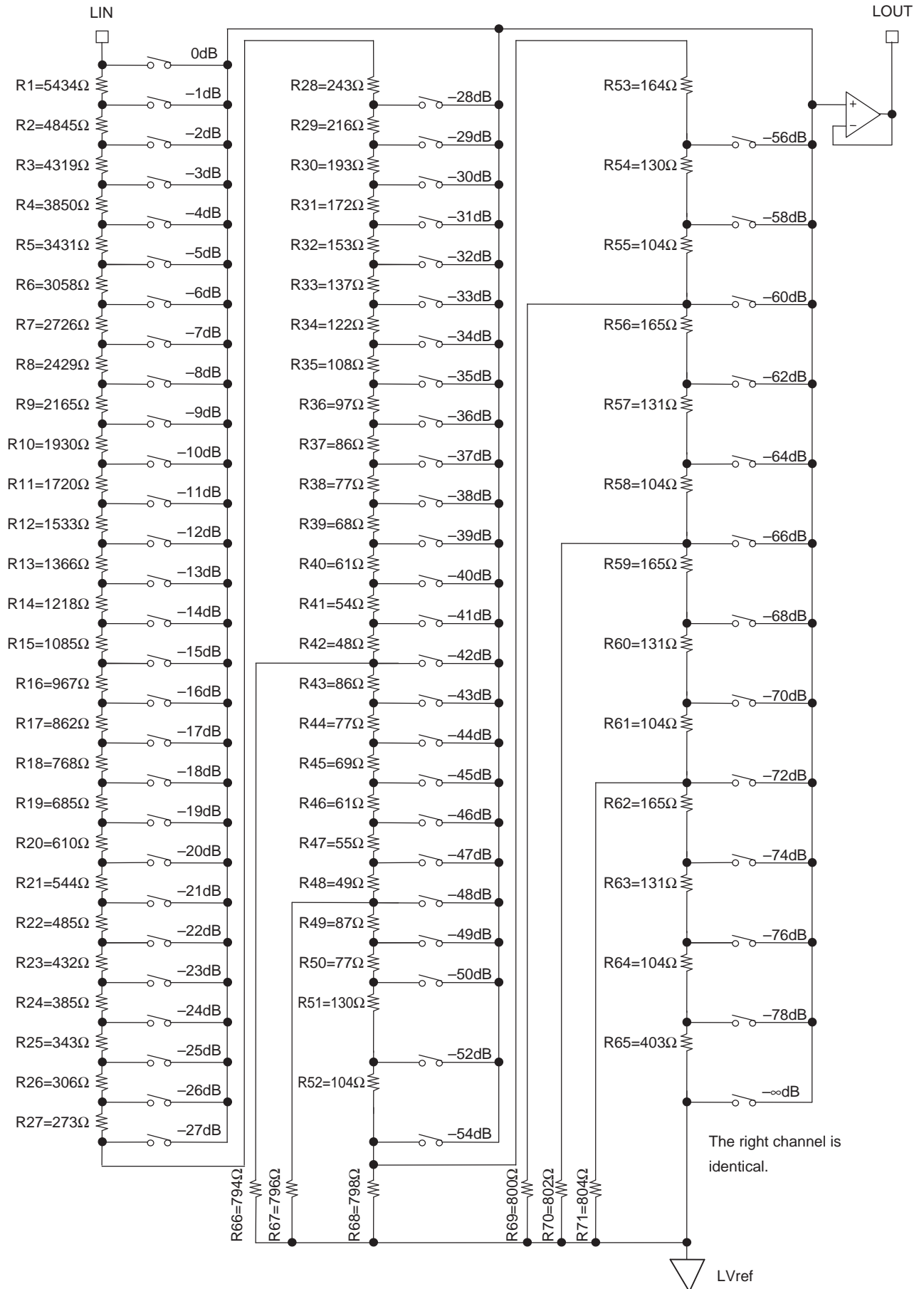
## LC75344M

### Pin Functions

Pin No.	Pin	Function	Notes
1 10	LIN RIN	Volume control inputs	
2 9	LOUT ROUT	Volume control outputs	
7	Vref	<p><math>V_{DD} \times 0.5</math> voltage generator block for the analog ground level.</p> <p>A capacitor with a value a few times <math>10 \mu\text{F}</math> must be inserted between Vref and AVSS (<math>V_{SS}</math>) to minimize power supply ripple.</p>	
8	$V_{SS}$	Ground	
3	$V_{DD}$	Power supply	
6	CE	<p>Chip enable</p> <p>The internal latch data is written and the analog switches operate at the point this pin goes from high to low. Data transfer is enabled when this pin is at the high level.</p>	
4 5	DI CL	Serial data and clock inputs for IC control.	

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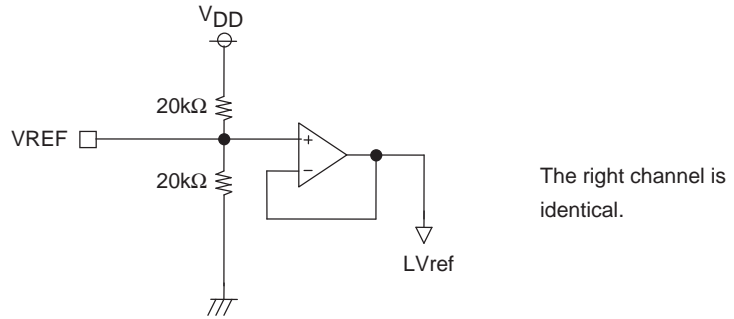
## Internal Equivalent Circuit





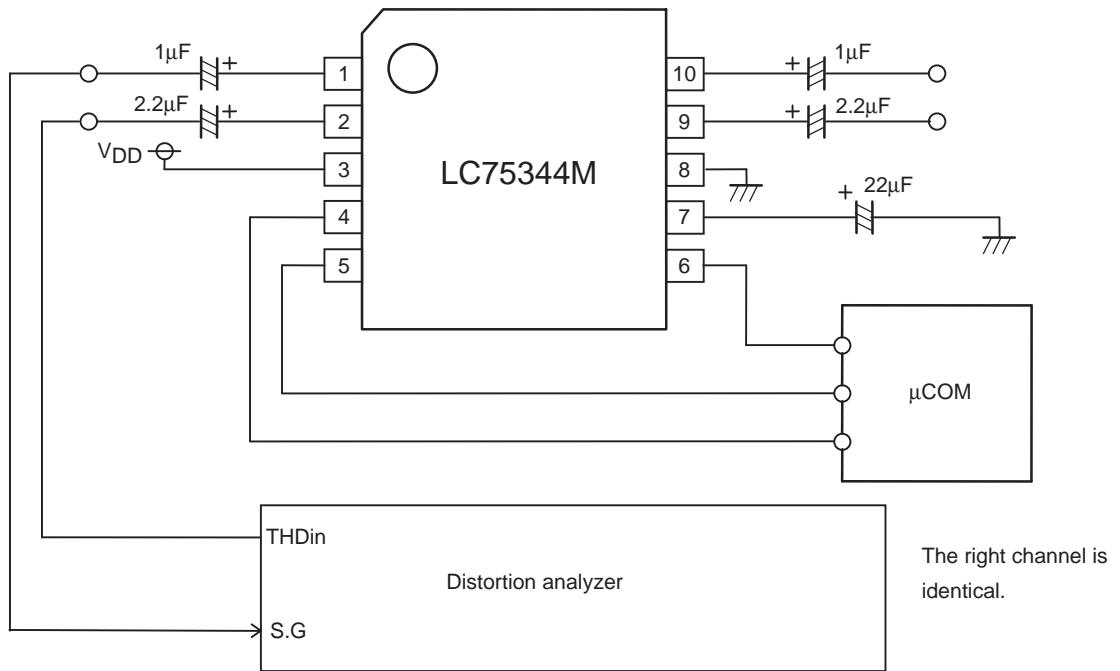
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## Reference Voltage Generator Equivalent Circuit



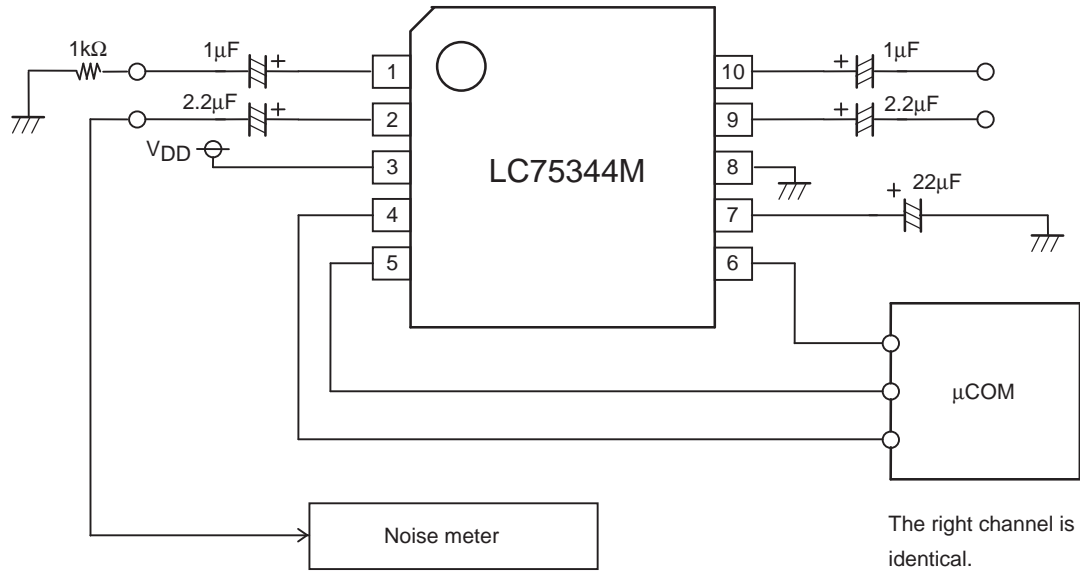
## Test Circuits

- Total harmonic distortion

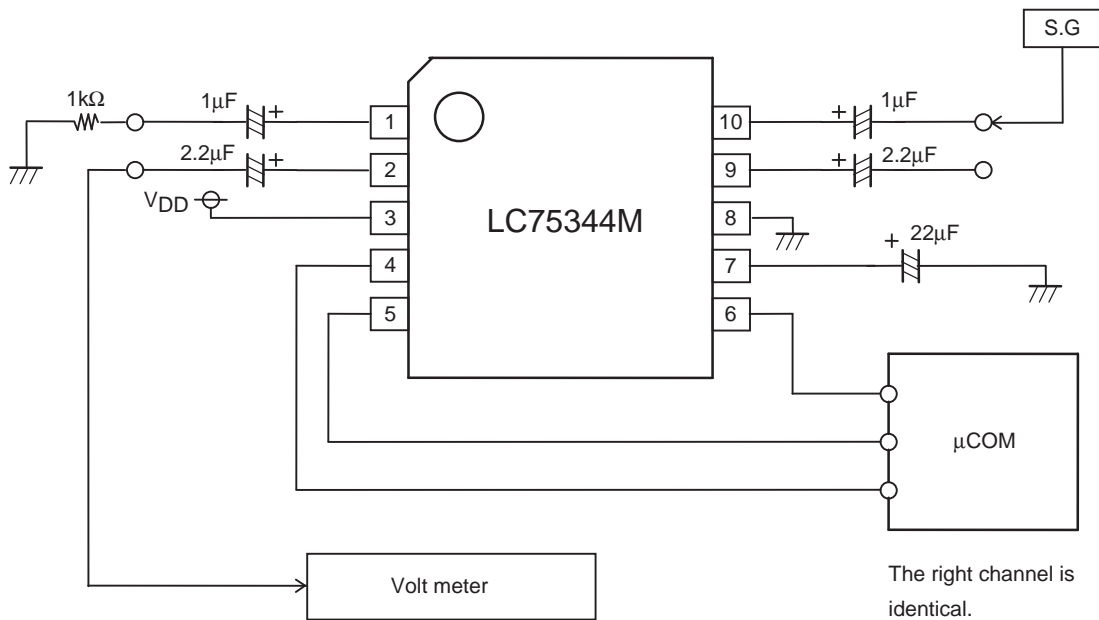


## LC75344M

### • Output noise voltage

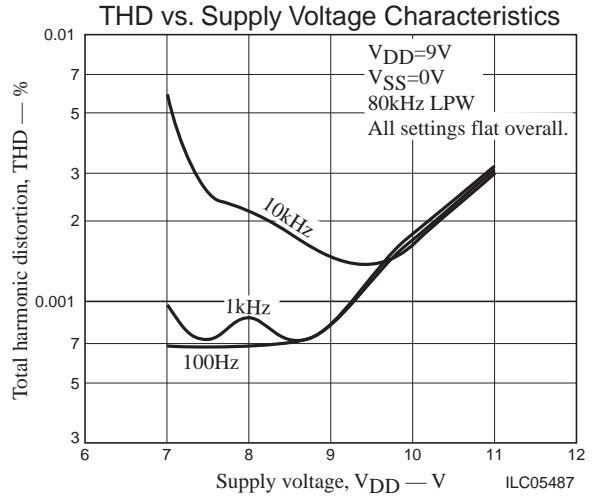
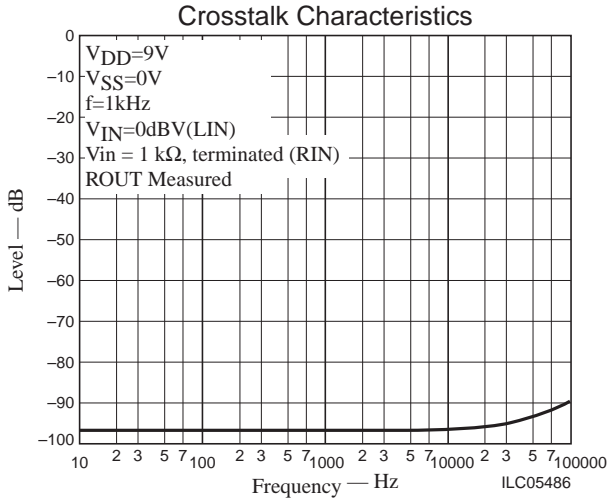
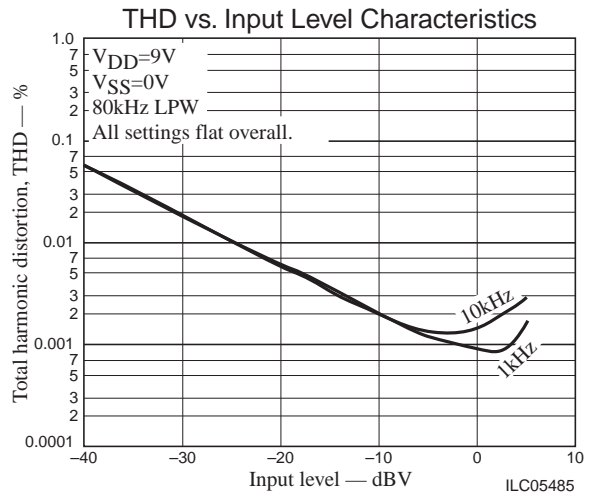
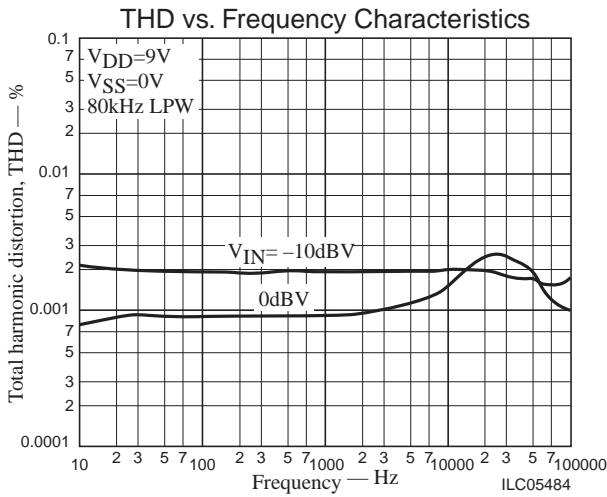
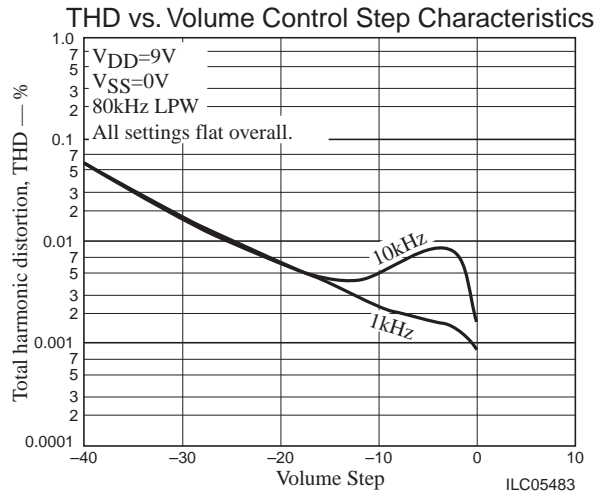
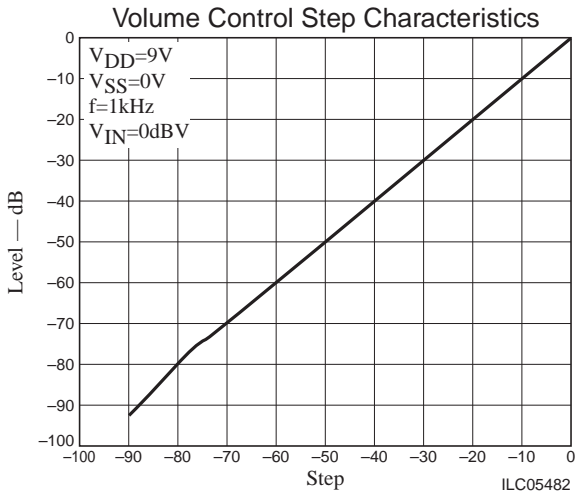


### • Crosstalk



### Usage Notes

- The states of the internal analog switches are undefined after power is first applied. Muting must be applied externally until the control data has been sent.
- When performing the initial settings after power is first applied, both the left and right channel initial settings data must be sent before releasing the external mute.
- Either cover the CL, DI, and CE lines with the ground pattern or use shielded lines to prevent high-frequency digital noise from entering the analog signal system from these lines.



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