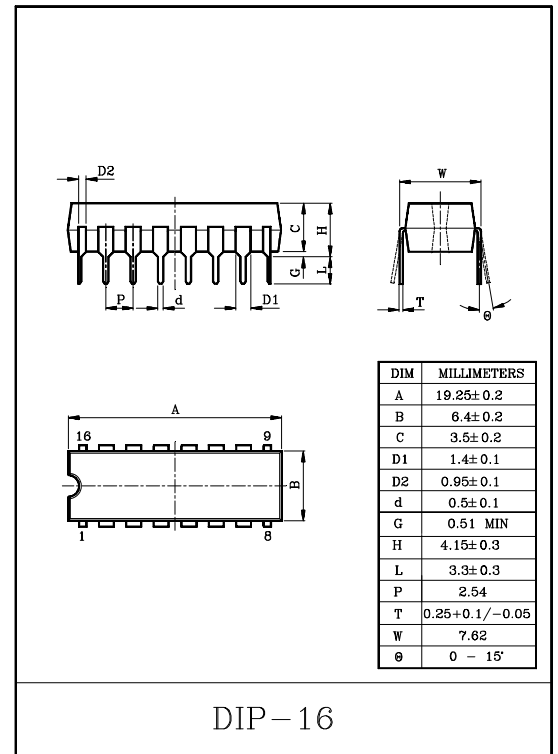


ELECTRONIC VOLUME CONTROL IC

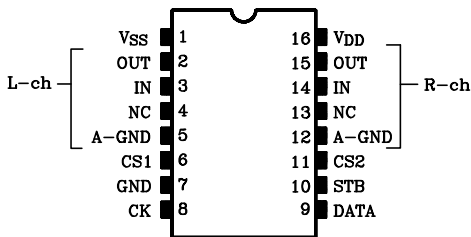
KIC9299P is electronic volume control IC developed for use in audio equipment such as home stereo sets. This IC control balance and rear speaker. The volume, balance and loudness circuits can be controlled by serial data which are input externally.

FEATURES

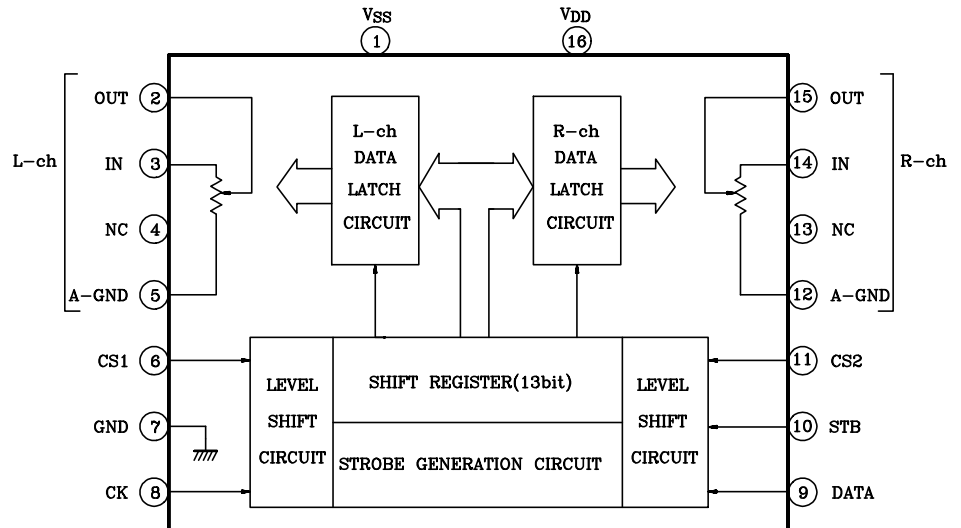
- Thirty-two level volume control in 1dB steps from 0dB to 30dB, ∞dB.
- The volume circuit features 2 built-in channels which can be controlled independently, thus controlling balance.
- Signal and dual power supply operation.
- Chip select input allows control of up to four of these chips on the same bus.
- Polysilicon resistors enables low-distortion, high-performance volume systems.
- Package is DIP-16 pin.



PIN CONNECTION



BLOCK DIAGRAM



KIC9299P

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Power Supply Voltage (1)	$V_{DD}-V_{SS}$	-0.3~36	V
Power Supply Voltage (2)	$V_{DD}-GND$	-0.3~20	V
GND Input Voltage	$V_{IN}(1)$	-0.3~ $V_{DD}+0.3$	V
V_{SS} Input Voltage	$V_{IN}(2)$	$V_{SS}-0.3\sim V_{DD}+0.3$	V
Power Dissipation	P_D	300	mW
Operating Temperature	T_{opr}	-40~85	°C
Storage Temperature	T_{stg}	-65~150	°C

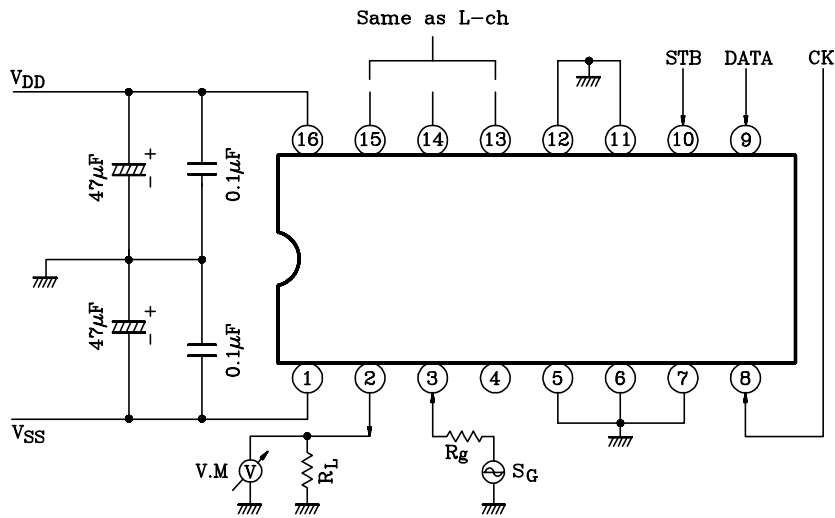
ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, $V_{DD}=15V$, $V_{SS}=-15V$, $GND=0V$, $T_a=25^\circ C$)

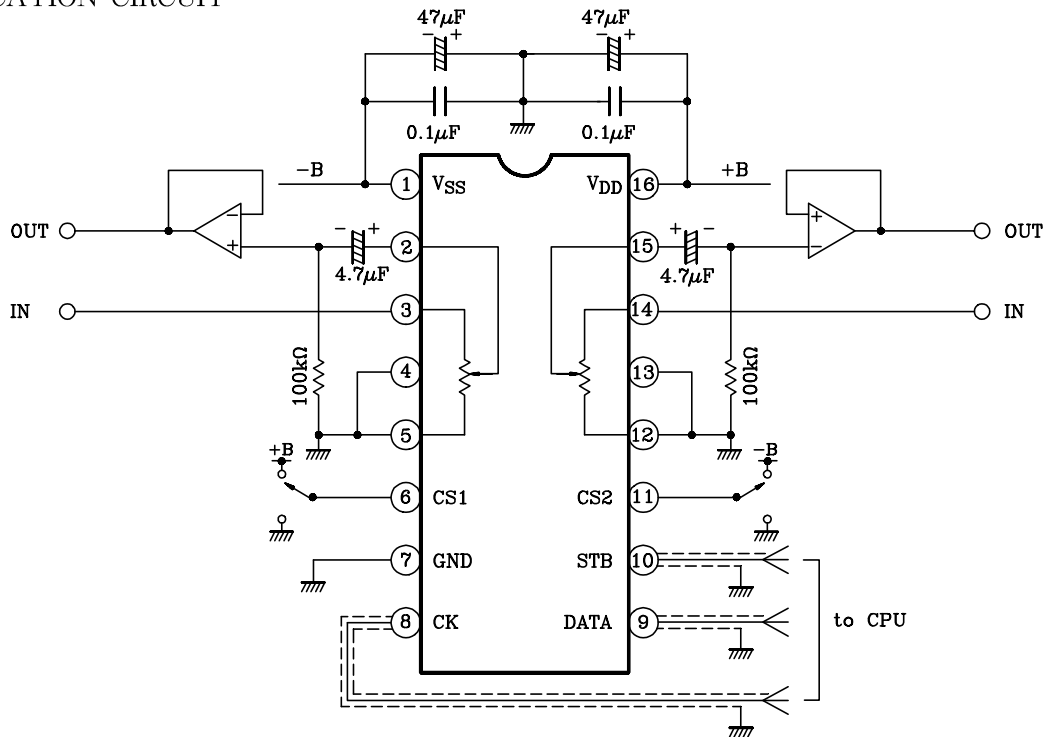
CHARACTERISTIC		SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Operating Supply Voltage (1)		$V_{DD}-V_{SS}$	-	Dual power supply operation	12.0	~	34	V	
Operating Supply Voltage (2)		$V_{DD}-GND$	-	Single power supply operation	6.0	~	18		
Operating Supply Current		I_{DD}	1	No load, No input	-	0.5	1.0	mA	
Input Voltage	"H" level	$V_{IH}(1)$	-	CK, DATA, STB terminal $V_{DD}=6.0\sim 18V$	4.0	~	V_{DD}	V	
	"L" level	$V_{IL}(1)$			GND	~	1.0		
Input Voltage	"H" level	$V_{IH}(2)$	-	CS1, CS2 terminal	$V_{DD}\times 0.7$	~	V_{DD}	V	
	"L" level	$V_{IL}(2)$			GND	~	$V_{DD}\times 0.3$		
Input Current	"H" level	I_{IH}	-	CK, DATA, STB, CS1, CS2 terminal	$V_{IH}=15V$	-	~	1.0	μA
	"L" level	I_{IL}			$V_{IL}=0V$	-1.0	-	-	
Operating Frequency		f_{op}	-	CK, DATA, STB terminal	0	~	1.0	MHz	
Minimum Clock Frequency		T_{ck}			0.5	-	-	μS	
Volume Resistance Value		R_{VR}	-	-	30	43	57	k Ω	
Step Deviation		ΔVR	-	Volume step deviation	-0.5	-	0.5	dB	
Analog Switch ON Resistance		R_{ON}	-	Internal analog switch	-	350	600	Ω	
Analog Switch OFF Leak Current		I_{OFF}			-0.1	-	0.1	μA	
Total Harmonic Distortion		THD	1	$f_{IN}=1kHz$ $V_{IN}=1V_{rms}$ $R_g=600\Omega$, $R_L=100k\Omega$ $BW=20Hz\sim 20kHz$	-	0.005	-	%	
Maximum Attenuation		ATT_{MAX}			-	100	-	dB	
Output Noise Voltage		V_N			-	1.0	-	μV_{rms}	
Cross Talk		C·T			-	100	-	dB	

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TEST CIRCUIT 1 ($I_{DD}/THD/ATT_{MAX}/V_N/C \cdot T$)



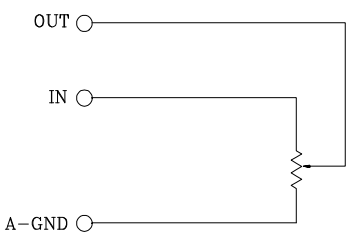
APPLICATION CIRCUIT



(Note) High-frequency digital signals are input to pins CK, DATA and STB. Since these signals may cause noise in analog circuits, either use shield wire for CK, DATA, and STB signal lines, or design the pattern so that these signal lines are protected by the ground line.

KIC9299P

DESCRIPTION of PIN FUNCTIONS

PIN NO.	SYMBOL	PIN NAME	FUNCTION AND OPERATION	NOTE
1	V _{SS}	Negative power supply pin	Dual power supply $\left\{ \begin{array}{l} V_{DD}=6.0\sim 17V \\ GND=0V \\ V_{SS}=-6.0\sim -17V \end{array} \right.$ Single power supply $\left\{ \begin{array}{l} V_{DD}=6.0\sim 18V \\ V_{SS}=GND=0V \end{array} \right.$	-
7	GND	Digital ground pin		
16	V _{DD}	Positive power supply pin		
2	L-OUT	Volume output pins	<ul style="list-style-type: none"> Volume circuit 	-
15	R-OUT			
3	L-IN	Volume input pins		
14	R-IN			
5	L-A-GND	Analog ground pins		
12	R-A-GND			
6	CS1	Chip select input pins		
11	CS2			
8	CK	Clock input pin	Clock input for data transfer	Low threshold value input pins
9	DATA	Data input pin	Serial data input for setting volume	
10	STB	Strobe input pin	Strobe input for writing data	
4, 13	NC	Not connected		-

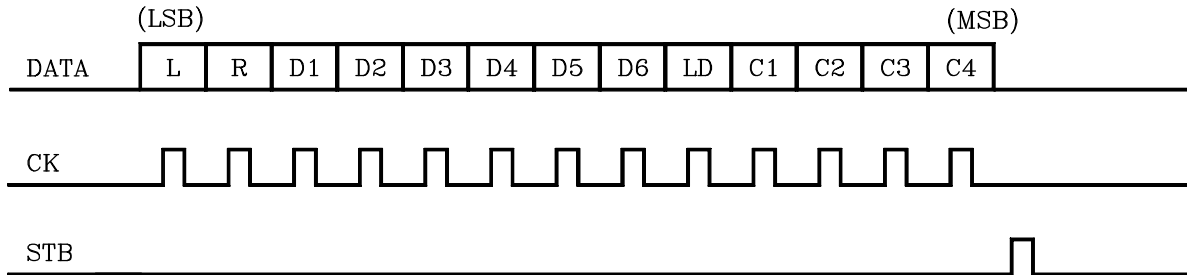
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OPERATIONS

1. Setting volume values (Attenuation)

The volume values are set using 13bit serial data.

- Data format



- (1) L is left channel select data, R is right channel select data.

When L=1, left channel volume is set. When R=1, right channel volume is set.

(When R=L=1, both channel volumes are set simultaneously)

- (2) 8, 9 bit data is set "0".

- (3) "D1" ~ "D5" are volume value setting data.

VOLUME VALUE	D1	D2	D3	D4	D5
0 dB	0	0	0	0	0
1	1	0	0	0	0
2	0	1	0	0	0
3	1	1	0	0	0
4	0	0	1	0	0
5	1	0	1	0	0
6	0	1	1	0	0
7	1	1	1	0	0
8	0	0	0	1	0
9	1	0	0	1	0
10	0	1	0	1	0
11	1	1	0	1	0
12	0	0	1	1	0
13	1	0	1	1	0
14	0	1	1	1	0
15	1	1	1	1	0

VOLUME VALUE	D1	D2	D3	D4	D5
16 dB	0	0	0	0	1
17	1	0	0	0	1
18	0	1	0	0	1
19	1	1	0	0	1
20	0	0	1	0	1
21	1	0	1	0	1
22	0	1	1	0	1
23	1	1	1	0	1
24	0	0	0	1	1
25	1	0	0	1	1
26	0	1	0	1	1
27	1	1	0	1	1
28	0	0	1	1	1
29	1	0	1	1	1
30	0	1	1	1	1
∞	1	1	1	1	1

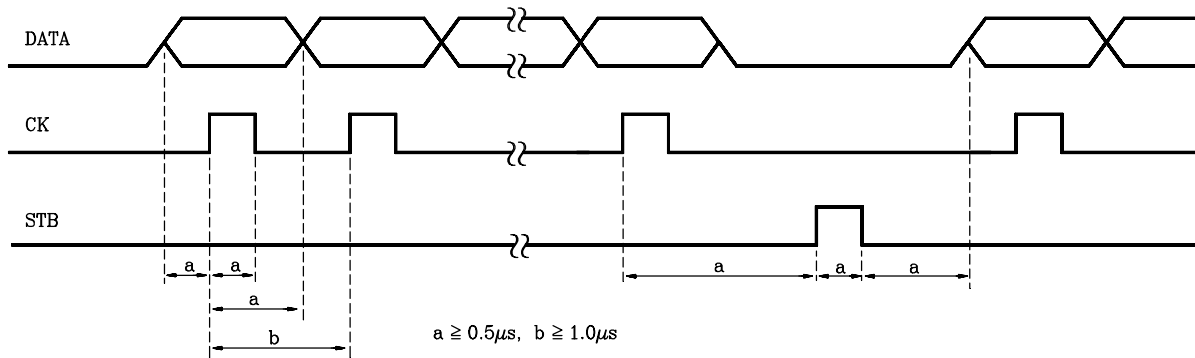
KIC9299P

- (4) "C1"~"C4" are chip select code data.
Code data are set according to CS1 and CS2 input.

CS1	CS2	C1	C2	C3	C4
L	L	0	0	1	1
H	L	1	0	1	1
L	H	0	1	1	1
H	H	1	1	1	1

2. Serial data timing

Input CK, DATA, and STB according to the following timing.

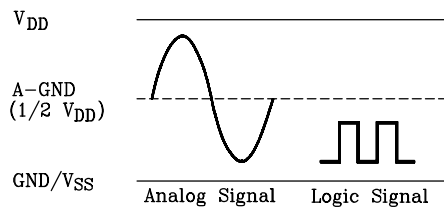


3. Single and dual power supply operation

KIC9299P is operate with single or dual power supplies.

With single or dual power supply, serial data logic level can be 0~5V.

- Single power supply operation



- Dual power supply operation

