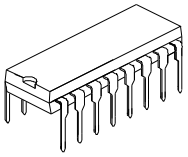
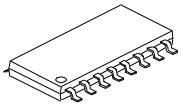
2-CH ELECTRONIC VOLUME CONTROLLER CONTROLLED BY SERIAL INTERFACE WITH LOUDNESS CONTROL

DESCRIPTION

The SC9260 and SC9260S are an optimum CMOS with I^2C interface on Chip, which has been designed for electrification of volume control of audio equipment, etc.



DIP-16-300-2.54



SOP-16-300-1.27

FEATURES

* Attenuation can be controlled from 0dB to -78dB by 2dB/step.
* This ICs feature a built-180in loudness circuit.(20dB tap)
* The volume, balance and loudness circuits can be controlled by I^2C series data.
* CS (Chip Select) input allows control of up to 2 of this chip on the same bus.
* Use Polysilicon resistors enable low-distortion, high-performance volume system.
* Package is DIP-16 and SOP-16

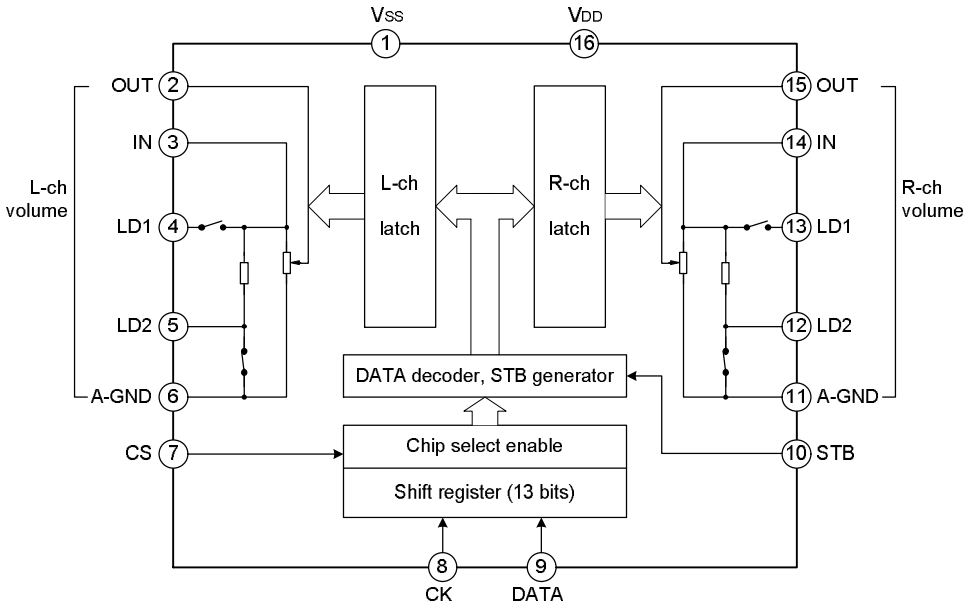
ORDERING INFORMATION

Device	Package
SC9260	DIP-16-300-2.54
SC9260S	SOP-16-300-1.27

APPLICATIONS

* Digital volume control Radio
* CD, VCD and DVD system volume control
* DTS system volume control
* Audio system volume control

BLOCK DIAGRAM



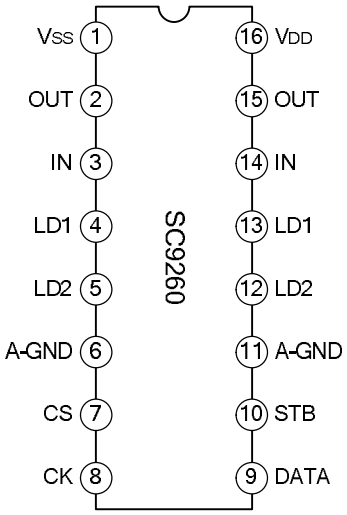
ABSOLUTE MAXIMUM RATINGS (Tamb=25°C)

Characteristics	Symbol	Value	Unit
Supply Voltage	V_{DD}	-0.3~15	V
Input Voltage	V_{IN}	-0.3~V_{DD}+0.3	V
Power Dissipation	P_D	300	mW
Operating Temperature	T_{opr}	-40~85	°C
Storage Temperature	T_{stg}	-55~150	°C

ELECTRICAL CHARACTERISTICS (Unless otherwise specified, Tamb=25°C, V_{DD}=9 V)

Characteristics		Symbol	Test condition		Min.	Typ.	Max.	Unit
Operating Supply Voltage		V_{DD}	Tamb=-40~85°C		4.5	9.0	12	V
Operating Supply Current		I_{DD}	No load		-	0.3	1.0	mA
Input Voltage	"H" Level	$V_{IH(1)}$	CK, DATA, STB input pin		4.0	-	V_{DD}	V
	"L" Level	$V_{IL(1)}$	V_{DD}=4.5~12V		0	-	1.0	
Input Voltage	"H" Level	$V_{IH(2)}$	CS input pin		V_{DD}x0.7	-	V_{DD}	V
	"L" Level	$V_{IL(2)}$			0	-	V_{DD}x0.3	
Input Current	"H" Level	I_{IH}	All input pin	V_{IH}=V_{DD}	-1	-	1	μA
	"L" Level	I_{IL}		V_{IL}=0V	-1	-	1	
Volume Resistance Value		RVR	Loudness "OFF"		20	28	37	kΩ
Analog Switch ON Resistance		RON	-		-	250	600	Ω
Attenuation Error		ΔATT			-	0	±2	dB
Volume Balance Between Left And Right		ΔRVR	Volume error between left and right		-	0	±3	%
Total Harmonic Distortion		THD	f_{IN}=1kHz	0dB	-	0.01	-	%
Maximum Attenuation		ATTM	V_{IN}=1Vrms	∞dB	-	100	-	dB
Cross Talk		CT	R_L=100KΩ	0dB	-	100	-	dB
Output Noise Voltage		V_N	R_g=600Ω		-	2.0	-	μVrms
Operation Frequency		fop	CK, DATA, STB		-	-	500	kHz
Minimum Pulse Width		T_{CK}	CK input		-	0.5	1.0	μs
		T_{STB}	STB input		-	1.0	2.0	

PIN CONFIGURATION



PIN DESCRIPTIONS

Pin no.	Pin name	Description
1	VSS	Digital ground pin
2	L-OUT	Left channel volume output pin
3	L-IN	Left channel volume input pin
4	L-LD1	Left channel tap output pins for loudness (1)
5	L-LD2	Left channel tap output pins for loudness (2)
6	L-GND	Analog ground pins
7	CS	Chip select input pin. Input pin for designating chip select code. This pin correspond to bit "C1" which is chip select bit in serial data. When CS="1" and C1="1", data is valid. When CS="0" and C1="0", data is valid.
8	CK	Clock input pin. Clock input for data transfer.
9	DATA	Data input pin. Attenuation channel selection data input terminal. Data consists of 13 bits and input by CK signal.
10	STB	Strobe input pin. Attenuation setting signal take from DATA and CK terminals are latched when this terminal is placed at "H" level.
11	R-GND	Analog ground pins
12	R-LD2	Right channel tap output pins for loudness (2)
13	R-LD1	Right channel tap output pins for loudness (1)
14	R-IN	Right channel volume input pin
15	R-OUT	Right channel volume output pin

16	V_{DD}	Power supply pin.

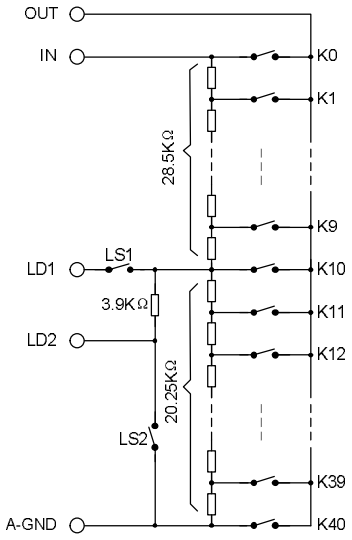
FUNCTION DESCRIPTION

1. Volume circuit

Volume circuit consist of ladder resistor and analog switch.

Tap for loudness is connected to step 10 (20dB). Loudness operation is controlled by LS1/LS2 switches.

Equivalence circuit



Volume step and attenuation

Step	attenuation	step	attenuation
K0	0(dB)	K21	42
K1	2	K22	44
K2	4	K23	46
K3	6	K24	48
K4	8	K25	50
K5	10	K26	52
K6	12	K27	54
K7	14	K28	56
K8	16	K29	58
K9	18	K30	60
K10	20	K31	62
K11	22	K32	64
K12	24	K33	66
K13	26	K34	68
K14	28	K35	70
K15	30	K36	72
K16	32	K37	74
K17	34	K38	76
K18	36	K39	78
K19	38	K40	∞
K20	40		

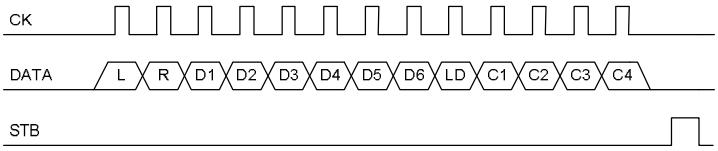
Loudness ON: LS1=ON, LS2=OFF Loudness OFF: LS1=OFF, LS2=ON.

2. Setting volume values

Optional attenuation data is input through the DATA, CK and STB terminals.

Data consists of 18 bits as follows

(1) Serial data format



(2)Chip select code (C1~C4)

Chip select code is set to use serial bus line in common with other ICs. Data C2, C3, C4 is fixed 0, 1, 1 in SC9260. When level of CS input pin (7 pin) correspond to C1 bit, data is valid.

CS	C1	C2	C3	C4
"1"	1	0	1	1
"0"	0	0	1	1
			Fixed	

(3)L is left-channel select data; R is right-channel select data (L/R)

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

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

(4)LD is loudness setting data

When LD="0", loudness is OFF (LS1=OFF, LS2=ON)

When LD="1", loudness is ON (LS1=ON, LS2=OFF)

(5)Volume setting data (D1~D6)

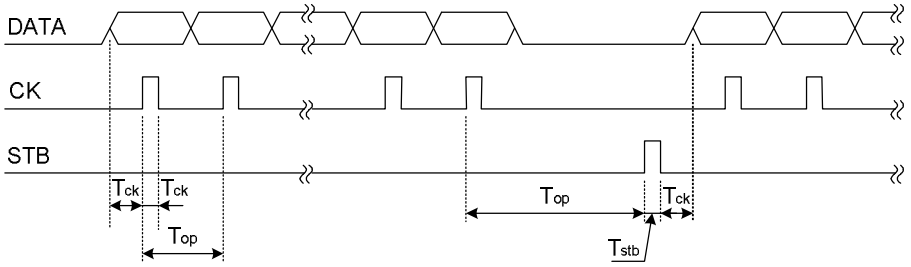
List of volume data and step

Enabled Switch	D1	D2	D3	D4	D5	D6	Enabled Switch	D1	D2	D3	D4	D5	D6
K0	0	0	0	0	0	0	K20	0	0	1	0	1	0
K1	1	0	0	0	0	0	K21	1	0	1	0	1	0
K2	0	1	0	0	0	0	K22	0	1	1	0	1	0
K3	1	1	0	0	0	0	K23	1	1	1	0	1	0
K4	0	0	1	0	0	0	K24	0	0	0	1	1	0
K5	1	0	1	0	0	0	K25	1	0	0	1	1	0
K6	0	1	1	0	0	0	K26	0	1	0	1	1	0
K7	1	1	1	0	0	0	K27	1	1	0	1	1	0
K8	0	0	0	1	0	0	K28	0	0	1	1	1	0
K9	1	0	0	1	0	0	K29	1	0	1	1	1	0
K10	0	1	0	1	0	0	K30	0	1	1	1	1	0
K11	1	1	0	1	0	0	K31	1	1	1	1	1	0
K12	0	0	1	1	0	0	K32	0	0	0	0	0	1
K13	1	0	1	1	0	0	K33	1	0	0	0	0	1
K14	0	1	1	1	0	0	K34	0	1	0	0	0	1
K15	1	1	1	1	0	0	K35	1	1	0	0	0	1
K16	0	0	0	0	1	0	K36	0	0	1	0	0	1
K17	1	0	0	0	1	0	K37	1	0	1	0	0	1
K18	0	1	0	0	1	0	K38	0	1	1	0	0	1
K19	1	1	0	0	1	0	K39	1	1	1	0	0	1
							K40	0	0	0	1	0	1

(Note) if data other than those listed above are input, volume values are undefined.

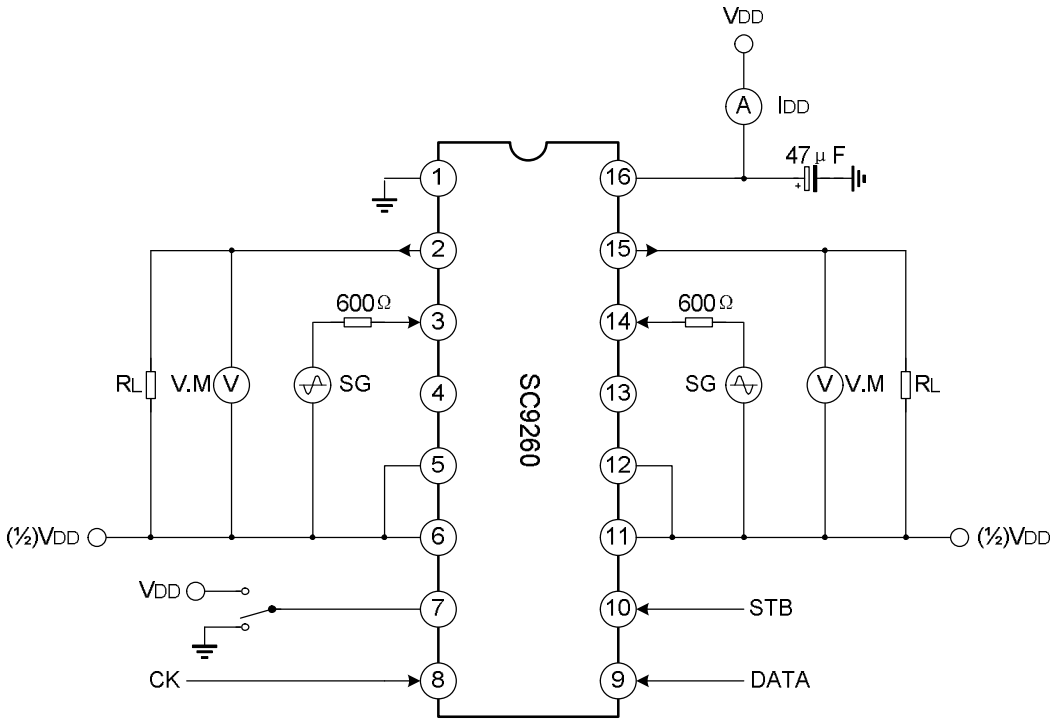
(6)Serial data timing

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

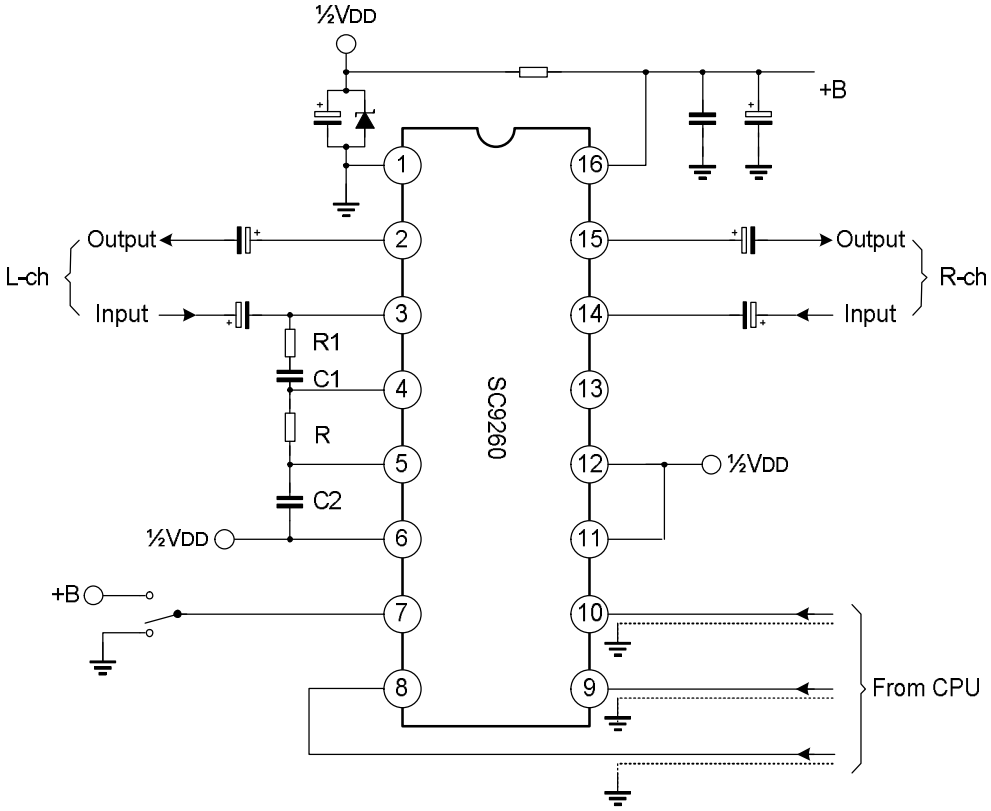


T_{ck}>1 μ s, T_{op}>2 μ s, T_{stb}>2 μ s

TEST CIRCUIT



TYPICAL APPLICATION CIRCUIT



Note: L-ch circuit is loudness operation; R-ch circuit is without loudness.

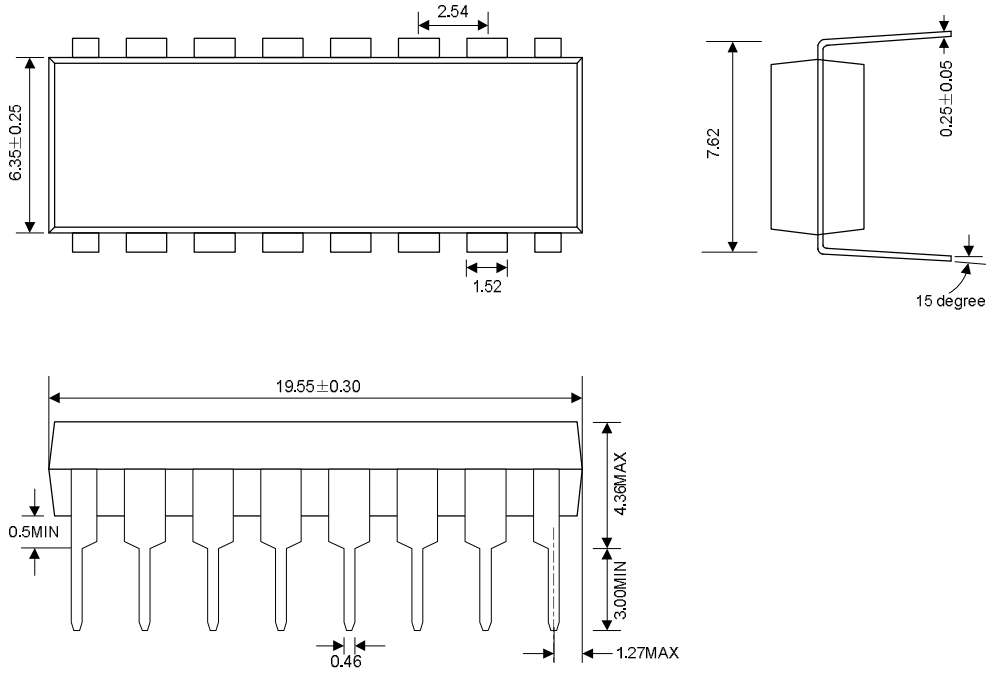
R1=8.2kΩ, C1=1500pF C2=0.1μF

For preventing noise when loudness is turned on or off, R=22kΩ~470kΩ

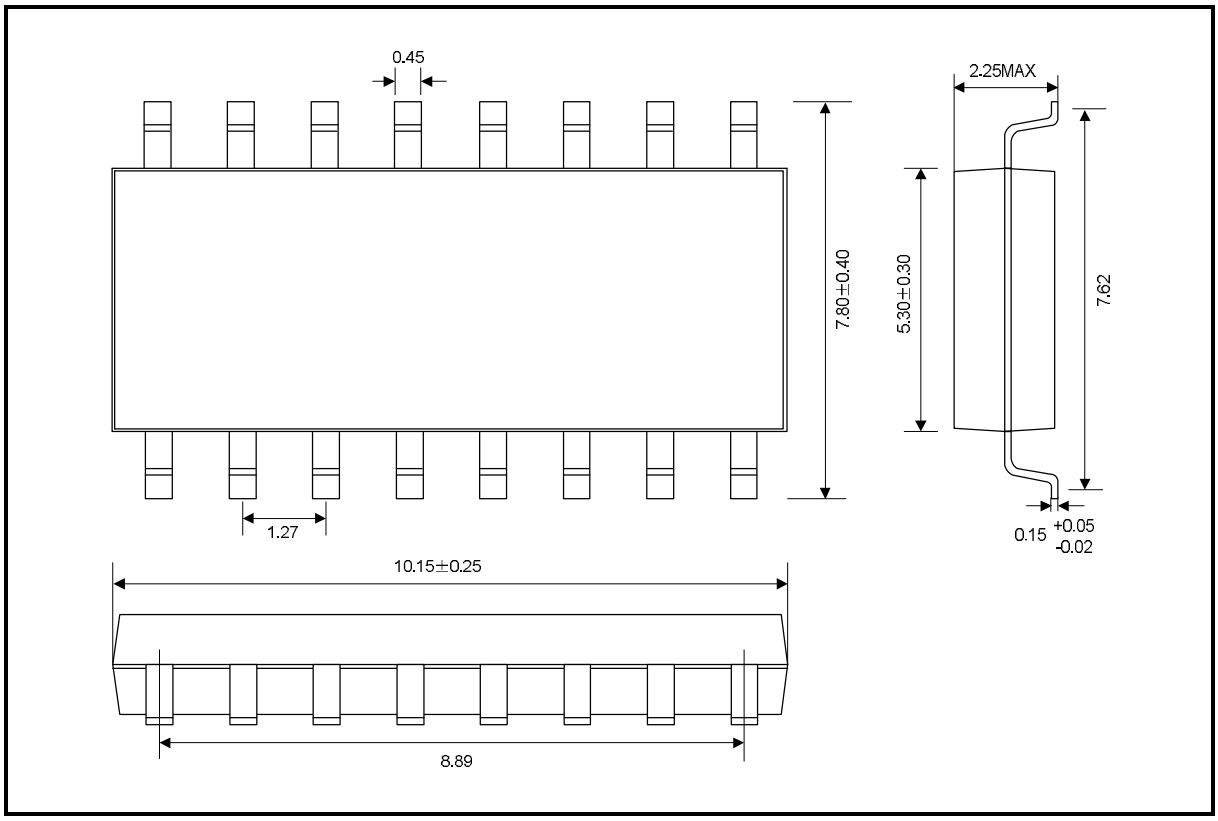
High- frequency digital signals are input to pins CK, DATA and STB. Since these signals may cause noise in analog circuits, either use shield wire for CK, DATA, and STB signal lines, or design the pattern so that these signal lines are protected by the ground line.

PACKAGE OUTLINE

DIP-16-300-2.54 UNIT: mm



SOP-16-300-1.27 UNIT: mm


0.45
2.25MAX
7.80±0.40
5.30±0.30
7.62
1.27
0.15 +0.05 -0.02
10.15±0.25
8.89

HANDLING MOS DEVICES:

Electrostatic charges can exist in many things. All of our MOS devices are internally protected against electrostatic discharge but they can be damaged if the following precautions are not taken:

- Persons at a work bench should be earthed via a wrist strap.
- Equipment cases should be earthed.
- All tools used during assembly, including soldering tools and solder baths, must be earthed.
- MOS devices should be packed for dispatch in antistatic/conductive containers.