

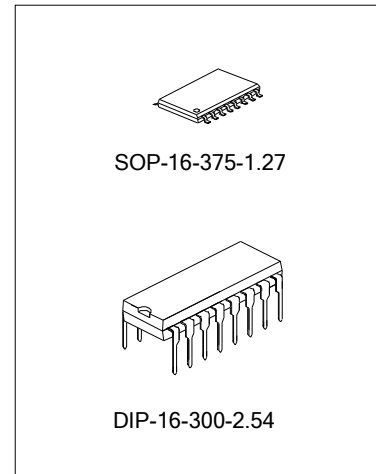
2-CH AUDIO POWER AMPLIFIER (2W x 2)

DESCRIPTION

The SC7422 is a class AB power amplifier which designed for dual audio purpose. It can deliver 2W x 2 power output to the 4Ω load in the 5V operation voltage. Total harmonic distortion is lower than 0.03%. The output mode can be switched between the SE and BTL mode. The volume also can be changed by a 32 steps volume controller. Moreover, the SC7422 requires a few extra components in the application. It is suitable for small or portable products.

FEATURES

- * Operation voltage : 5V
- * Output power : 2W × 2 (RL=4Ω)
- * Low harmonics distortion (THD=0.03%)
- * 32 steps volume control with 1.5dB per step from -45dB to 0dB
- * Two output modes (SE and BTL) switched
- * Low quiescent operation current
- * No POPO noise when turn on/off
- * Standby function, Low standby current (Is<0.7μA)
- * Thermally protected



ORDERING INFORMATION

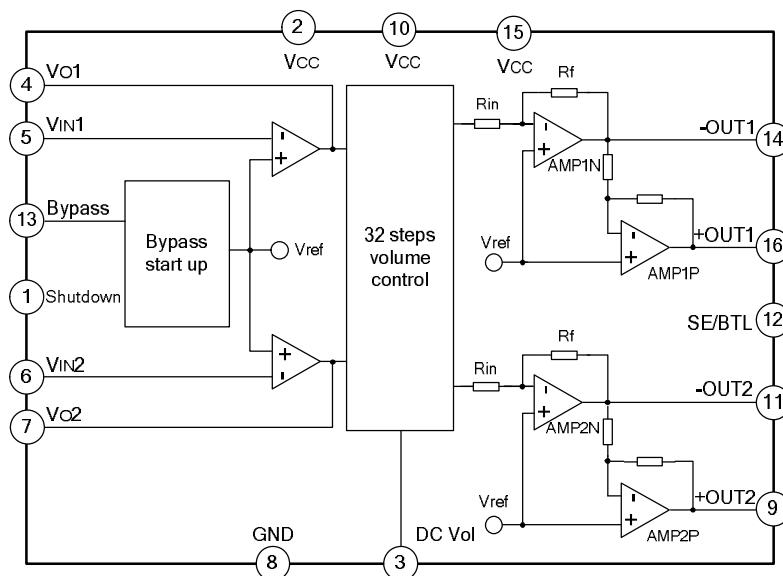
Device	Package
SC7422	DIP-16-300-2.54
SC7422S	SOP-16-375-1.27

APPLICATIONS

- * LCD Monitors for TV
- * Portable audio
- * Multimedia audio
- * Other audio applications

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BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATING

Characteristics	Symbol	Rating	Unit
Supply Voltage	VCC	0 ~7	V
Maximum Input Voltage For Any Pin	Vin(max)	-0.3 ~ VCC +0.3	V
Maximum Input Current For Each Input Pin (*)	Iin(max)	-10 ~+10	mA
Operating Ambient Temperature	Tamb	-40 ~+85	°C
Storage Temperature	Tstg	-65 ~+150	°C
Thermal Resistance From Junction To Ambient	θ_{JA}	88.8 (**)	°C/W
Thermal Resistance From Junction To Case	θ_{JC}	26 (**)	°C/W

(*) Maximum instantaneous input current for any pin must be less than 100mA, so that the CMOS latch-up effect can be avoided.

(**) Ambient Temperature: Tamb=25°C.

ELECTRICAL CHARACTERISTICS

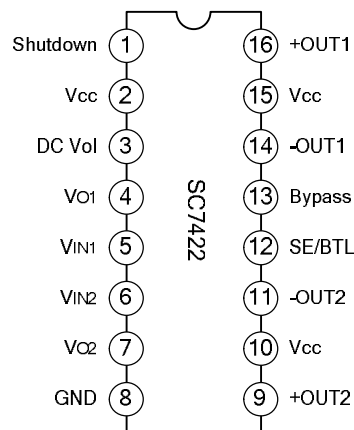
(Refer to the test circuit, VCC=5V; f=22Hz~22KHz; Tamb=25°C, unless otherwise specified.)

Characteristics	Symbol	Test conditions	Min.	Typ.	Max.	Unit	
Supply Voltage	VCC		3	5	6	V	
Quiescent Operation Current	Is	BTL	8	10	14	mA	
		SE	6	8	12	mA	
		Shutdown = ON	0.2	0.7	1	μA	
Output Power	Po	BTL	THD=1%, RL=8Ω	1.0	1.1	1.1	W
			THD=10%, RL=8Ω	1.2	1.4	1.6	
			THD=1%, RL=4Ω	1.4	1.6	1.8	
			THD=10%, RL=4Ω	1.8	2.0	2.1	
	SE	THD=1%, RL=32Ω	80	85	90	mW	
THD=10%, RL=32Ω		100	110	120			
Total Harmonic Distortion	THD	BTL	Po=0.2W, RL=4Ω	0.03	0.05	0.07	%
			Po=1W, RL=4Ω	0.06	0.08	0.15	%
		SE	Po=50mW, RL=32Ω	0.03	0.05	0.07	%
Volume Control Range	Vatt	DC Vol = 5V, F = 1kHz	-1	0	+1	dB	
		DC Vol = 17%Vcc	-44	-45	-46		
Volume Control Step	Vstep	Vatt = 0 ~ -45dB	1.3	1.5	1.7	dB	
Mute	Mute	DC Vol = 0V	-85	-88	-90	dB	
Channel Balance	CB	Rin = Rf = 20kΩ	-1	0	+1	dB	
Channel Separate	CS	BTL	F=1kHz	85	88	91	dB
				SE	77	80	
Signal-to-Noise Ratio	SNR		85	90	91	dB	
Output Noise Voltage	Vno		25	40	50	μV	

(To be continued)

(Continued)

Characteristics	Symbol	Test conditions	Min.	Typ.	Max.	Unit	
Output Offset Voltage	V _{off}	DC Vol = 0V From +OUT to -OUT	25	50	100	mV	
Supply Voltage Ripple Rejection	SVRR	BTL	F=1kHz	58	60	63	dB
		SE		52	55	58	
Thermally protected	TH	Overheat to shutdown	-	120	-	°C	
		Return to normal operation	-	80	-		
Input Voltage For Shutdown Pin	VSD	Shutdown = OFF	V _{CC} =3~5V		20%	30%	V _{CC}
		Shutdown = ON		50%	60%		
Input Voltage For SE/BTL Pin	VSB	BTL	V _{CC} =3~5V		10%	20%	V _{CC}
		SE		80%	90%		

PIN CONFIGURATION**PIN DESCRIPTION**

Pin No.	Pin Name	I/O	Pin Description
1	Shutdown	I	Stand-by control, logic high active
2	VCC	--	Supply
3	DC Vol	I	Volume control
4	VO1	I	Buffer output of channel 1
5	VIN1	I	Signal input of channel 1
6	VIN2	I	Signal input of channel 2
7	VO2	I	Buffer output of channel 2
8	GND	--	Ground
9	+OUT2	O	Non inverted loudspeaker output of channel 2
10	VCC	--	Supply
11	-OUT2	O	Inverted loudspeaker output of channel 2
12	SE/BTL	I	Output mode control. When this pin is logic high, SE mode is selected. When it is logic low, BTL mode is selected.

(To be continued)

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Pin No.	Pin Name	I/O	Pin Description
13	Bypass	O	Half supply voltage ripple rejection
14	-OUT1	O	Inverted loudspeaker output of channel 1
15	Vcc	--	Supply
16	+OUT1	O	Non inverted loudspeaker output of channel 1

FUNCTION DESCRIPTION

Gain Setting for Input Stage

The gain for each audio input stage of the SC7422 is set by external resistors R1 and R2 (see **typical application circuit**). It is recommended that $R1 = R2 = 20k\Omega$ in the application and the gain is 0dB.

If the amplitude of audio input voltage is lower, for example, the peak-peak value is less than 2Vpp, it should be improve the gain, whereas, it should be reduce the gain. However, the amplitude of audio input voltage is so high that the output wave would be distortion. Therefore, the amplitude of audio signal source should be checked at first. And the gain in the application should be set following Table 1.

Table 1 Gain Setting for Input Stage

Operation Voltage	The peak-peak value of input voltage	Gain Setting for Input Stage	Operation Voltage	The peak-peak value of input voltage	Gain Setting for Input Stage
Vcc=3V	VIN < 1.25Vpp	+6dB	Vcc=5V	VIN < 2Vpp	+6dB
	VIN < 2.5Vpp	0dB		VIN < 4Vpp	0dB
	VIN < 5Vpp	-6dB		VIN < 8Vpp	-6dB

Otherwise, the minimum value of input resistor R1 is 10k Ω , in order to ensure proper impedance for input.

32 Steps Volume Control

The SC7422 includes a 32 steps volume controller. It changes the volume gain linearly with 1.5dB per step from -45dB to 0dB. The volume is controlled by input voltage of DC Vol pin. As the voltage was increasing, the volume is louder. Table 2 shows the relationship of them.

Table 2 32 Steps Volume Setting

Step	Volume (dB)	DC Vol VH(%)	DC Vol VL(%)	Step	Volume (dB)	DC Vol VH(%)	DC Vol VL(%)
1	0	Vcc	64.2	17	-24	38.1	30.4
2	-1.5	64.4	62.8	18	-25.5	35.6	29.0
3	-3	63.0	61.2	19	-27	31.8	27.4
4	-4.5	61.4	59.4	20	-28.5	29.2	25.4
5	-6	59.8	57.6	21	-30	27.6	23.8

(To be continued)

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Step	Volume (dB)	DC Vol VH(%)	DC Vol VL(%)	Step	Volume (dB)	DC Vol VH(%)	DC Vol VL(%)
6	-7.5	57.9	56.0	22	31.5	26.2	21.8
7	-9	56.1	54.0	23	-33	24.0	20.0
8	-10.5	54.1	51.8	24	-34.5	22.5	18.0
9	-12	52.1	48.8	25	-36	20.4	14.4
10	-13.5	49.4	47.4	26	-37.5	18.0	13.0
11	-15	47.5	45.4	27	-39	15.1	11.0
12	-16.5	45.5	43.6	28	-40.5	13.1	9.0
13	-18	44.0	41.6	29	-42	10.6	7.2
14	-19.5	41.8	39.8	30	-43.5	8.8	5.4
15	-21	39.8	37.6	31	-45	6.7	3.0
16	-22.5	38.3	36.6	32	MUTE	4.3	GND

Output Mode Control

The output mode of the SC7422 can be switched between the SE (Single-Ended) and BTL (Bridge-Tied Load) mode. It is recommended to apply BTL mode to obtain more output power while driving the loud speaker. SE mode can be set to shutdown some parts of amplifiers while driving the stereo headphone. Therefore, the quiescent operation current is reduced.

POPO Noise Suppress

When an audio power amplifier with a single supply turns on, the POPO Noise can be heard. The reason is that the output voltage of amplifier would take hundreds of milliseconds to increase from 0V to 1/2 Vcc.

This time is controlled by CB, the external capacitor of Bypass pin. As the CB was increasing, the time is longer, so it is much better to suppress POPO noise. However, the charging and discharging time for the input or output capacitors should be less than this time. Therefore, CB is related with the input or output capacitors. The values of these capacitors are recommended in the **typical application circuit**.

Thermally protected

There is a thermally protected protection circuit in the SC7422. If the chip temperature is over 120°C, the protection circuit will start up to shutdown the output stages of audio power amplifier. The chip will return to the normal operation, until the chip temperature falls to 80°C.

Power Dissipation and Heat Sinking

When the load is a resistor, the maximum of average power dissipation for the SC7422 is calculated as follows:

$$P_{DISS(MAX)} = 2(2V_{CC})^2 / (2\pi^2 R_L) + P_Q$$

Where Vcc is the operation voltage, RL is the load resistor, PQ is the static power consumption.

$$P_Q = V_{CC} \times I_s$$

Where Is is the operation current. For example, if the SC7422 drives the 4 Ω load in 5V supply, the power dissipation is 2.6W.

There is the formula of heat sinking for the SC7422:

$$\theta_{JA} = (T_{J(max)} - T_A) / P_{DISS}$$

Where θ_{JA} is the thermal resistance from junction to ambient, $T_{J(max)}$ is the junction temperature, T_A is ambient temperature, P_{DISS} is the power dissipation.

If the junction temperature remains below 150°C but the ambient temperature has reached to 50°C, the total junction-to-ambient thermal resistance must be less than θ_{JA} calculated as follows:

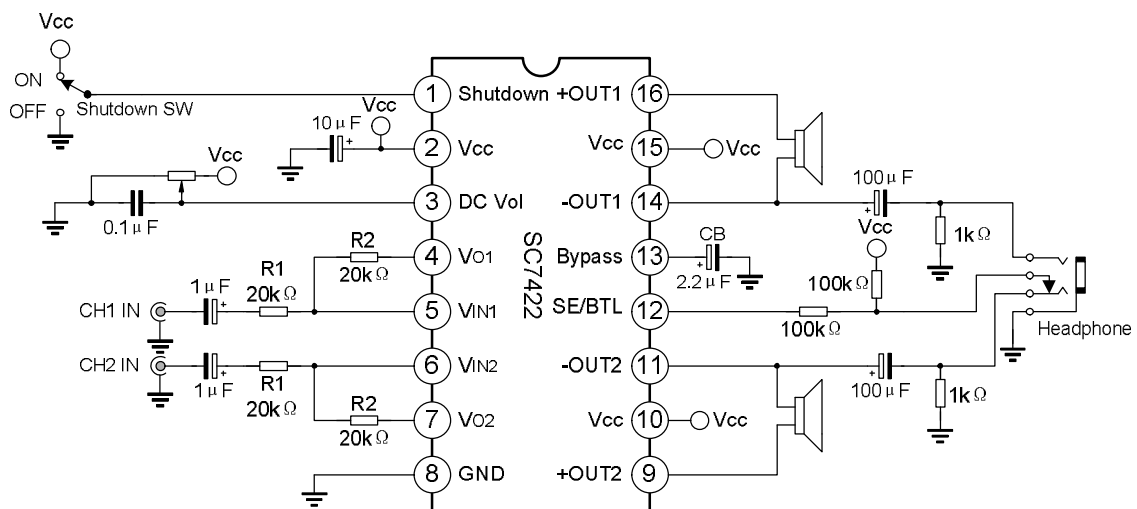
$$\theta_{JA} = (150^{\circ}\text{C} - 50^{\circ}\text{C}) / 2.6\text{W} = 38.4^{\circ}\text{C/W}.$$

Using $\theta_{JC} = 26^{\circ}\text{C/W}$, the heat-sink thermal resistance must be less than:

$$\theta_{JA} - \theta_{JC} = 12.4^{\circ}\text{C/W}$$

So the SC7422 doesn't need heat sink in the normal operation. In application, the copper foil which connects GND on PCB can be utilized for heat sinking to maintain proper operation temperature.

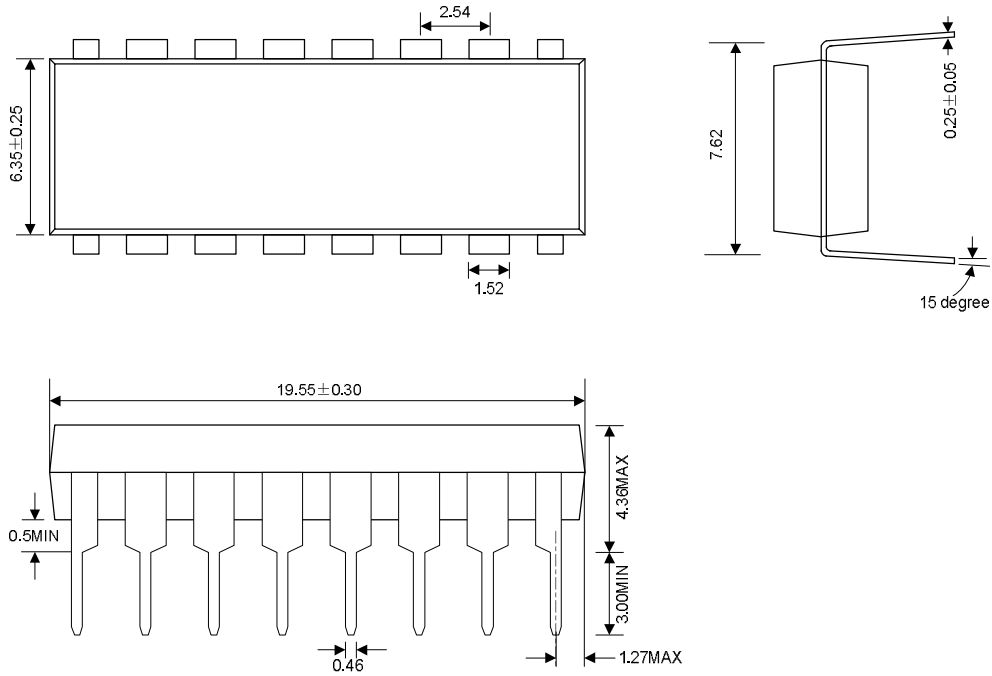
TYPICAL APPLICATION CIRCUIT



PACKAGE OUTLINE

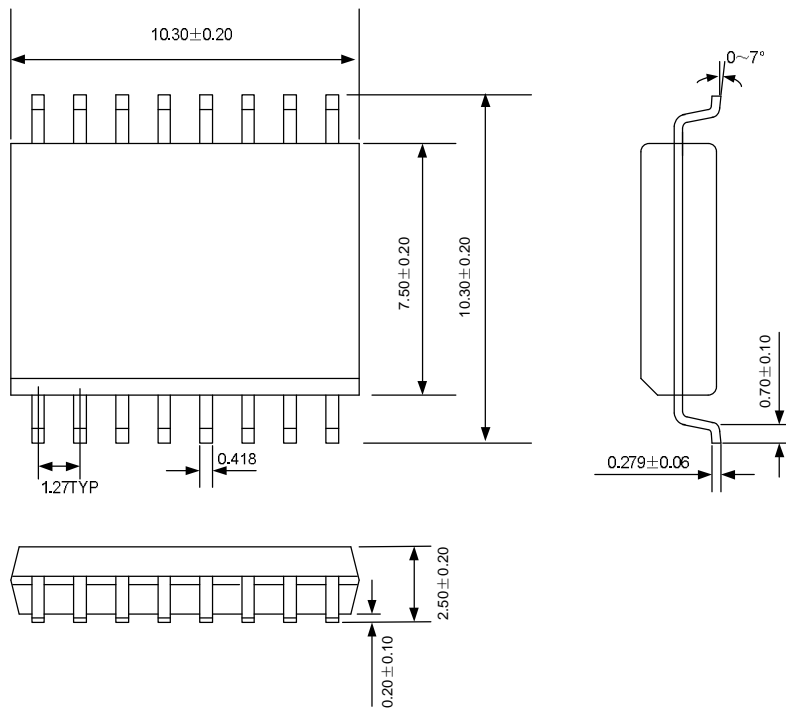
DIP-16-300-2.54

Unit: mm



SOP-16-375-1.27

Unit: mm



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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.