

**Stereo Pre-Amplifier/Power-Amplifier with 3V Governor**

**Description**

The CXA1635S/M is an IC designed for 3V headphone stereo, and provides all functions required for a headphone stereo on a single chip.

**Features**

- Output capacitors are not required
- Built-in bass boost function (10dB at 125Hz Typ.)
- Built-in motor speed controller
- Few external parts
- Wide operating supply voltage range (1.8 to 4.5V)

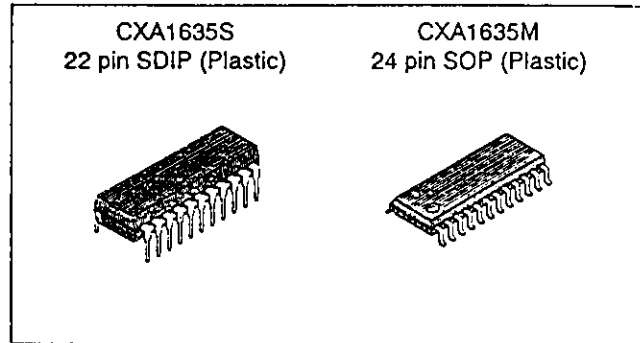
**Absolute Maximum Ratings (Ta=25°C)**

- Supply voltage Vcc 7 V
- Operating temperature Topr -20 to +75 °C
- Storage temperature Tstg -65 to +150 °C
- Allowable power dissipation
 

|                           |     |    |
|---------------------------|-----|----|
| P <sub>D</sub> (CXA1635S) | 880 | mW |
| (CXA1635M)                | 570 | mW |

**Operating Conditions**

- Supply voltage Vcc 1.8 to 4.5 V



**Applications**

3V headphone stereos

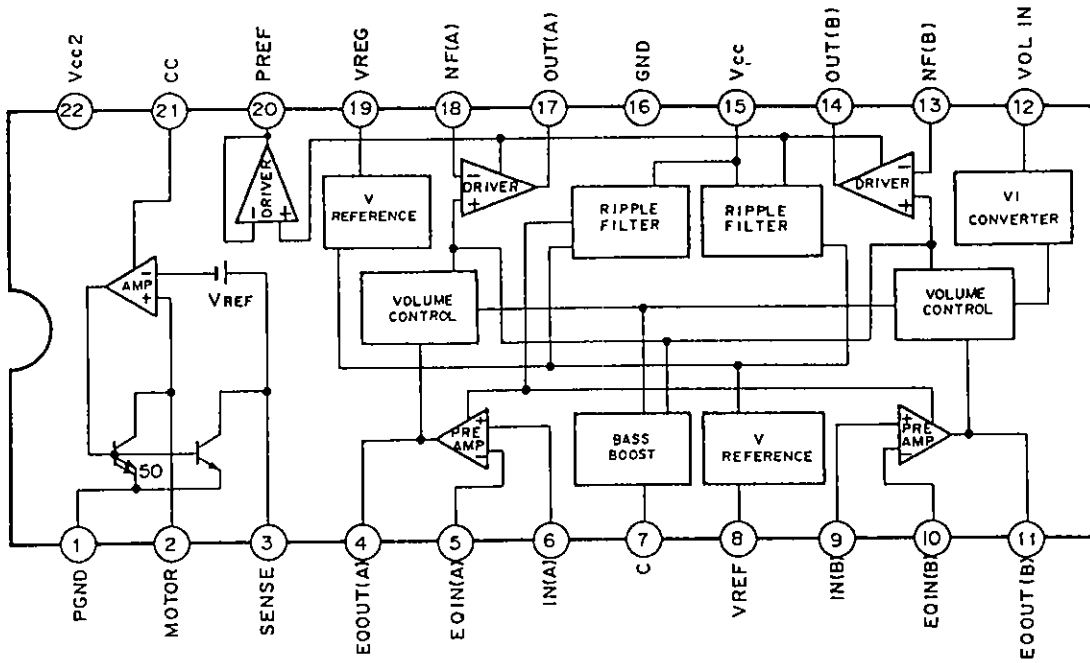
**Structure**

Bipolar silicon monolithic IC

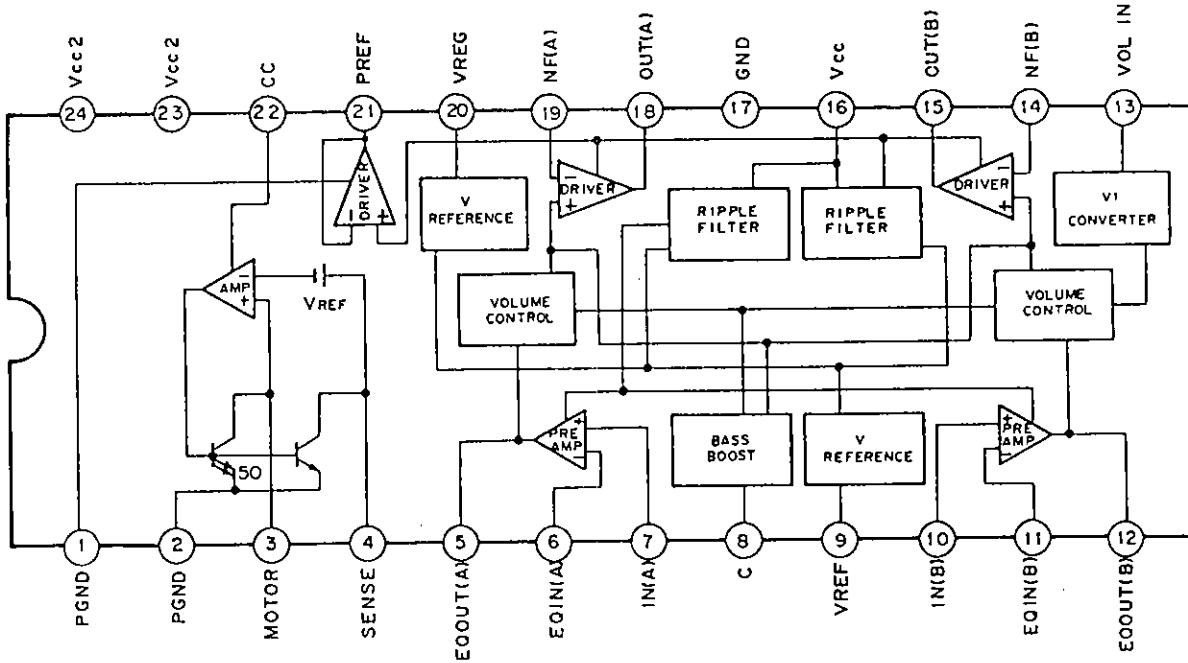
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Block Diagram

CXA1635S



CXA1635M



Pin Description

(Vcc=3V at no signal; pin numbers in brackets are for the CXA1635M.)

| Pin No.          | Symbol                 | Pin voltage | Equivalent circuit | Description  |
|------------------|------------------------|-------------|--------------------|--|
| 1 (1, 2)         | PGND                   | 0V          |                    | GND for governor block.                            |
| 2 (3)            | MOTOR                  |             |                    | Motor connection.                                  |
| 3 (4)            | SENSE                  |             |                    | Sense resistance connection.                       |
| 4 (5)<br>11 (12) | EQOUT (A)<br>EQOUT (B) | 1.5V        |                    | Pre-amplifier output/equalizer element connection. |
| 5 (6)<br>10 (11) | EQIN (A)<br>EQIN (B)   | 1.5V        |                    | Equalizer element connection.                      |

| Pin No.         | Symbol           | Pin voltage | Equivalent circuit | Description                        |
|-----------------|------------------|-------------|--------------------|------------------------------------|
| 6 (7)<br>9 (10) | IN (A)<br>IN (B) | 1.5V        |                    | Pre-amplifier input.               |
| 7 (8)           | C                | 1.5V        |                    | Bass boost capacitance connection. |
| 8 (9)           | VREF             | 1.5V        |                    | Reference bias voltage output.     |
| 12 (13)         | VOLIN            |             |                    | Volume control voltage input.      |

| Pin No.                       | Symbol                     | Pin voltage | Equivalent circuit | Description   |
|-------------------------------|----------------------------|-------------|--------------------|---|
| 13 (14)<br>18 (19)            | NF (A)<br>NF (B)           | 1.5V        |                    | Filter capacitance connection for headphone driver.   |
| 14 (15)<br>17 (18)<br>20 (21) | OUT (A)<br>OUT (B)<br>PREF | 1.5V        |                    | Headphone driver output.<br><br>(The pin voltages of OUT (A) and OUT (B) vary to approximately 1.6V, depending on the control voltage of Pin 12.) |
| 15 (16)                       | Vcc                        | 3.0V        |                    | Power supply.   |
| 16 (17)                       | GND                        | 0.0V        |                    | GND   |
| 19 (20)                       | VREG                       | 2.76V       |                    | Power supply filter.  |
| 21 (22)                       | CC                         | 2.3V        |                    | Phase compensation capacitance connection for motor speed controller.   |
| 22 (23, 24)                   | Vcc2                       | 3V          |                    | Power supply for governor block.  |

## Electrical Characteristics

(Ta=25°C, Vcc=3.0V, RL=32Ω; for switch settings, refer to the switch status table.)

|                | Item   | Symbol            | Measurement conditions  | Min. | Typ. | Max. | Unit |
|----------------|--|-------------------|---|------|------|------|------|
| Audio block    |  |                   |   |      |      |      |      |
| 1              | Current consumption                              | I <sub>CC</sub>   | No signal   | 6    | 11   | 15   | mA   |
| 2              | Voltage gain 1                                   | G <sub>V1</sub>   | V <sub>IN</sub> =-75dBm   | 62   | 64   | 68   | dB   |
| 3              | Voltage gain 2                                   | G <sub>V2</sub>   | V <sub>IN</sub> =-75dBm, vol=50%  | 51   | 55   | 58   | dB   |
| 4              | Voltage gain 3                                   | G <sub>V3</sub>   | V <sub>IN</sub> =-75dBm, BB ON  | 62   | 65   | 69   | dB   |
| 5              | Channel balance 1                                | Δ G <sub>V1</sub> | (G <sub>V1</sub> channel differential)  | -1.5 | 0    | 1.5  | dB   |
| 6              | Channel balance 2                                | Δ G <sub>V2</sub> | (G <sub>V2</sub> channel differential)  | -1.5 | 0    | 1.5  | dB   |
| 7              | Channel balance 3                                | Δ G <sub>V3</sub> | (G <sub>V3</sub> channel differential)  | -1.5 | 0    | 1.5  | dB   |
| 8              | Maximum volume attenuation                       | V <sub>MIN</sub>  | V <sub>IN</sub> =-65dBm   | 51   | 64   | —    | dB   |
| 9              | Maximum output                                   | P <sub>OMAX</sub> | THD=10%   | 24   | 35   | —    | mW   |
| 10             | Distortion factor 1                              | THD1              | V <sub>IN</sub> =-70dBm   | —    | 0.7  | 1.2  | %    |
| 11             | Distortion factor 2                              | THD2              | V <sub>IN</sub> =-60dBm, vol=50%  | —    | 0.5  | 1.0  | %    |
| 12             | Noise output                                     | V <sub>ND</sub>   | V <sub>IN</sub> : R <sub>g</sub> =2kΩ termination<br>A-weight filter                      | —    | -56  | -47  | dBm  |
| 13             | Ripple output                                    | V <sub>R</sub>    | V <sub>CC</sub> =2.5V, Δ V <sub>R</sub> =-30dBm   | —    | -53  | -44  | dBm  |
| 14             | Cross talk between channels<br>(A ↔ B)           | V <sub>CT</sub>   | A (B): V <sub>IN</sub> =-65dBm<br>B (A): V <sub>IN</sub> =R <sub>g</sub> =2kΩ termination | —    | -45  | -40  | dBm  |
| Governor block |  |                   |   |      |      |      |      |
| 15             | Internal reference voltage for<br>governor block | Δ V               | I <sub>m</sub> =100mA   |      | 1.00 |      | V    |
| 16             | Proportional constant                            | K                 | I <sub>m</sub> =100mA ± 10mA  |      | 50   |      | —    |

**Notes:** The input levels (V<sub>IN</sub>) indicated in the measurement conditions are specified for each input pin.

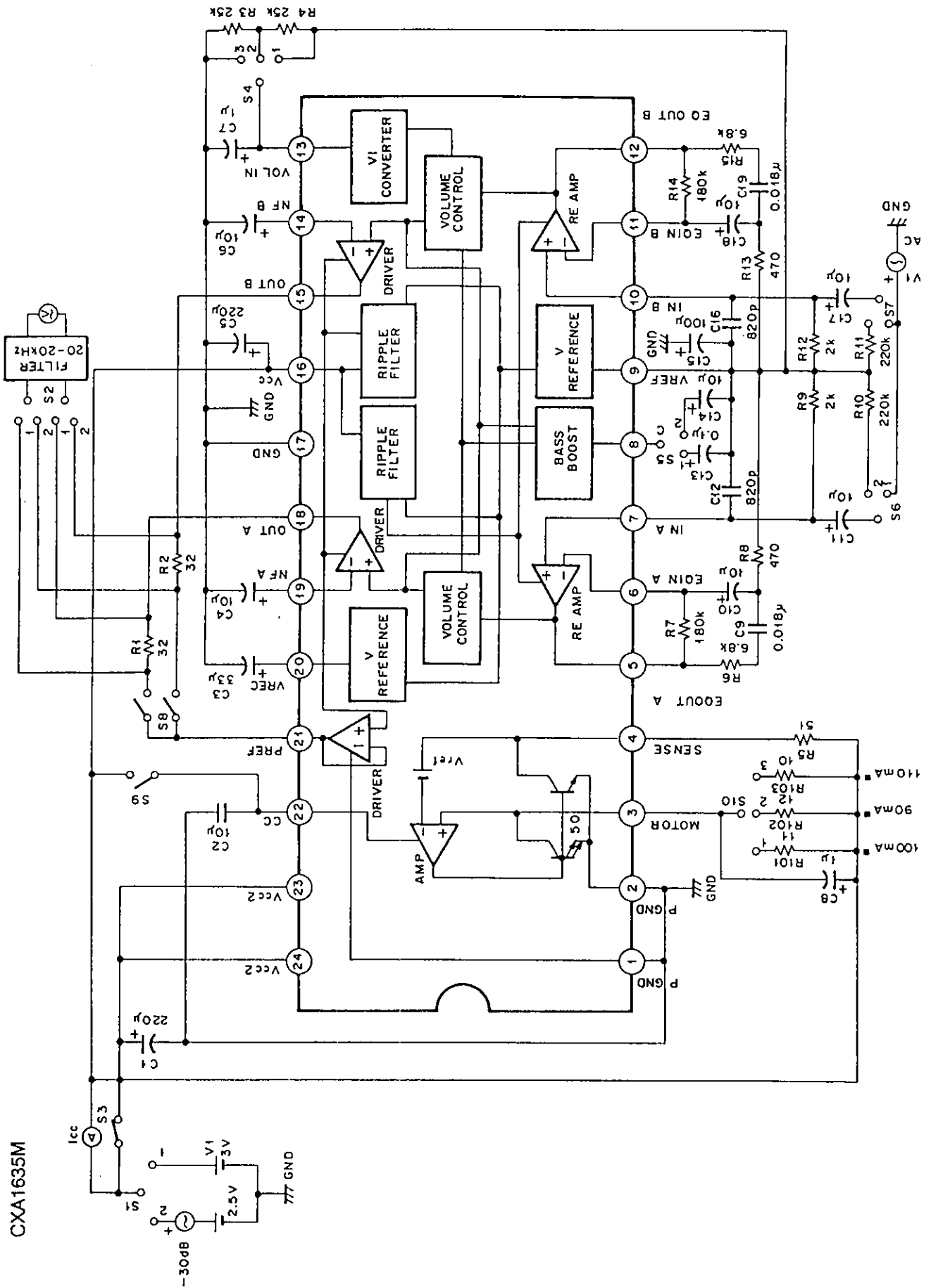
The input signal frequencies are all 1kHz and vol=100% is assumed when no conditions was specified.

Switch Statuses (When not specified, the switch is off.)

| Item           | Switch name                                   | 1<br>V<br>c<br>c | 2<br>A<br>C<br>V | 3<br>I<br>c<br>c | 4<br>V<br>R | 5<br>B<br>B | 6<br>I<br>N<br>(A) | 7<br>I<br>N<br>(B) | 8<br>R<br>L | 9<br>C<br>C | 10<br>M<br>O<br>T<br>O<br>R | 11<br>A<br>f<br>f<br>i<br>l<br>t | Input pins       | Test pins          |
|----------------|---|------------------|------------------|------------------|-------------|-------------|--------------------|--------------------|-------------|-------------|-----------------------------|----------------------------------|------------------|--------------------|
| Audio block    |   |                  |                  |                  |             |             |                    |                    |             |             |                             |                                  |                  |                    |
| 1              | Current consumption                           | 1                | 1                |                  | 1           | 2           | 2                  | 1                  |             | ON          |                             |                                  |                  | V1                 |
| 2              | Voltage gain 1                                | 1                | 1<br>2           | ON               | 1           | 2           | 1<br>2             | 1<br>2             | ON          | ON          |                             |                                  | IN (A)<br>IN (B) | OUT (A)<br>OUT (B) |
| 3              | Voltage gain 2                                | 1                | 1<br>2           | ON               | 2           | 2           | 1<br>2             | 1<br>2             | ON          | ON          |                             |                                  | IN (A)<br>IN (B) | OUT (A)<br>OUT (B) |
| 4              | Voltage gain 3                                | 1                | 1<br>2           | ON               | 1           | 1           | 1<br>2             | 1<br>2             | ON          | ON          |                             |                                  | IN (A)<br>IN (B) | OUT (A)<br>OUT (B) |
| 5              | Channel balance 1                             |                  |                  |                  |             |             |                    |                    |             |             |                             |                                  |                  |                    |
| 6              | Channel balance 2                             |                  |                  |                  |             |             |                    |                    |             |             |                             |                                  |                  |                    |
| 7              | Channel balance 3                             |                  |                  |                  |             |             |                    |                    |             |             |                             |                                  |                  |                    |
| 8              | Maximum volume attenuation                    | 1                | 1<br>2           | ON               | 3           | 2           | 1<br>2             | 1<br>2             | ON          | ON          |                             |                                  | IN (A)<br>IN (B) | OUT (A)<br>OUT (B) |
| 9              | Maximum output                                | 1                | 1<br>2           | ON               | 1           | 2           | 1<br>2             | 1<br>2             | ON          | ON          |                             |                                  | IN (A)<br>IN (B) | OUT (A)<br>OUT (B) |
| 10             | Distortion factor 1                           | 1                | 1<br>2           | ON               | 1           | 2           | 1<br>2             | 1<br>2             | ON          | ON          |                             |                                  | IN (A)<br>IN (B) | OUT (A)<br>OUT (B) |
| 11             | Distortion factor 2                           | 1                | 1<br>2           | ON               | 2           | 2           | 1<br>2             | 1<br>2             | ON          | ON          |                             |                                  | IN (A)<br>IN (B) | OUT (A)<br>OUT (B) |
| 12             | Noise output                                  | 1                | 1<br>2           | ON               | 1           | 2           | 1<br>2             | 1<br>2             | ON          | ON          |                             | ON                               |                  | OUT (A)<br>OUT (B) |
| 13             | Ripple output                                 | 2                | 1<br>2           | ON               | 1           | 2           | 1<br>2             | 1<br>2             | ON          | ON          |                             |                                  | Vcc              | OUT (A)<br>OUT (B) |
| 14             | Cross talk between channels<br>A→B<br>B→A     | 1                | 2<br>1           | ON               | 1           | 2           | 1<br>2             | 1<br>2             | ON          | ON          |                             |                                  | IN (A)<br>IN (B) | OUT (A)<br>OUT (B) |
| Governor block |   |                  |                  |                  |             |             |                    |                    |             |             |                             |                                  |                  |                    |
| 15             | Internal reference voltage for governor block | 1                | 1                | ON               | 3           | 1           | 2                  | 1                  | ON          |             | 1                           |                                  |                  |                    |
| 16             | Proportional constant                         | 1                | 1                |                  | ON          | 1           | 2                  | 1                  | ON          |             | 2<br>3                      |                                  |                  |                    |



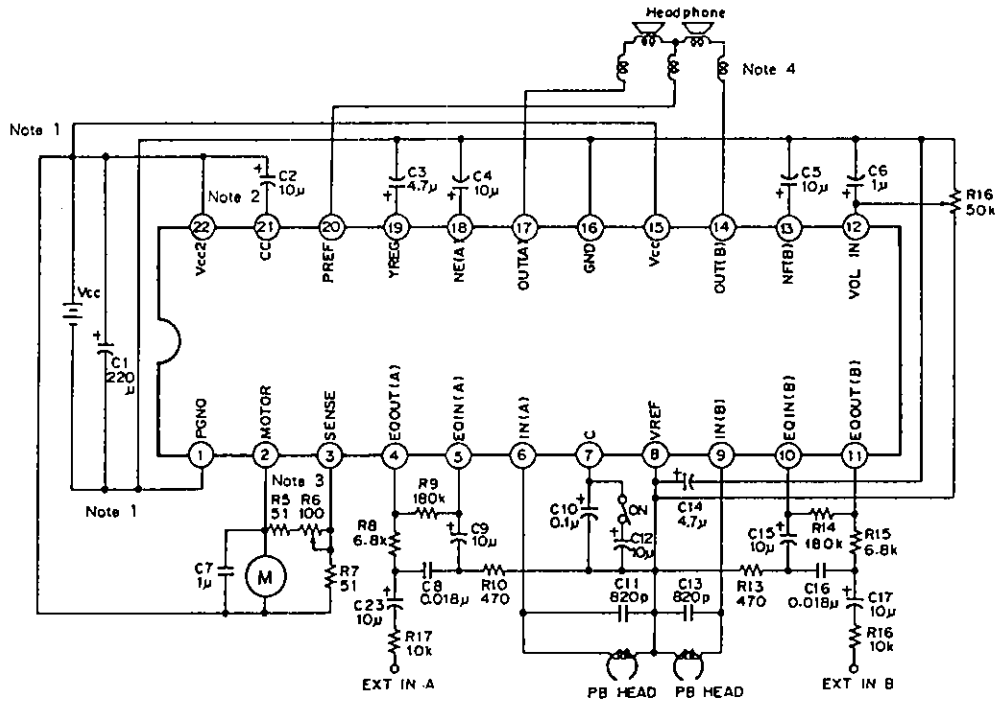




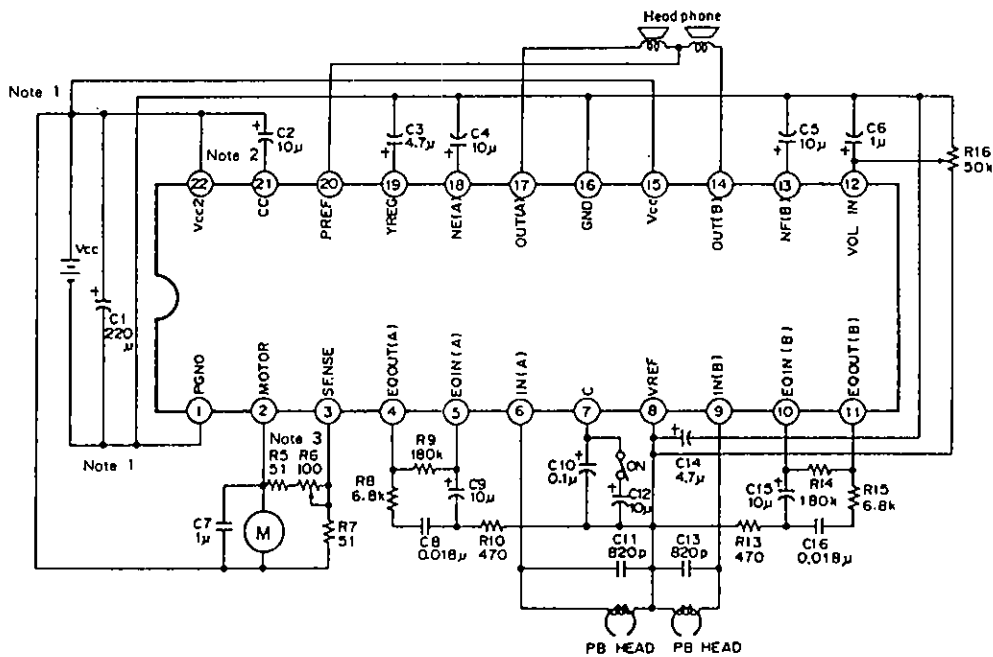
CXA1635M

Application Circuit

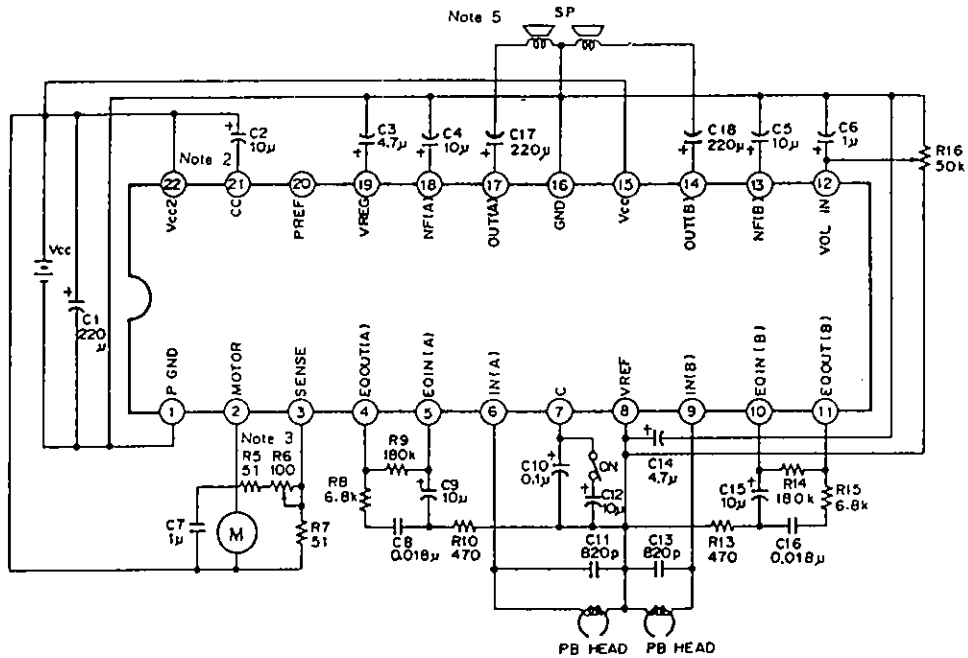
Pocketable headphone stereo player with radio



Pocketable headphone stereo player



Stereo cassette player with 8 Ω speaker

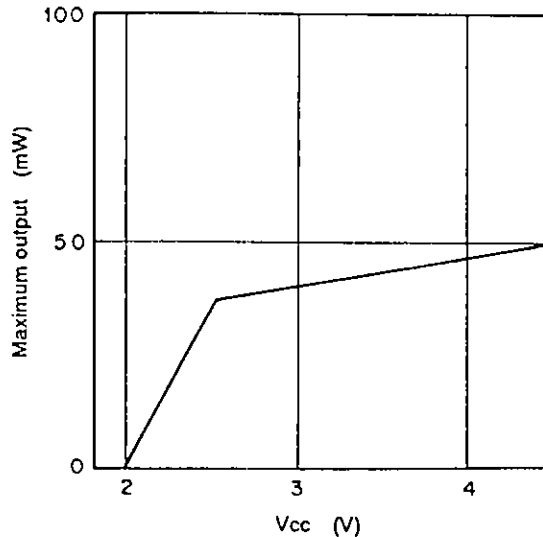


- Note 1) The pattern layout of Vcc and GND should be separated audio and motor speed controller blocks independently and then be connected at one point.
- Note 2) Select a capacitor for phase compensation of the motor control circuit that makes ripple to a minimum.
- Note 3) Select a resistor for motor speed control according to the motor.
- Note 4) Connect coils when radiation countermeasures are required.
- Note 5) Capacitor should be coupled as shown in the diagram when using 8 Ω speaker.

Application circuits shown are typical examples illustrating the operation of the devices. Sony cannot assume responsibility for any problems arising out of the use of these circuits or for any infringement of third party patent and other right due to same.

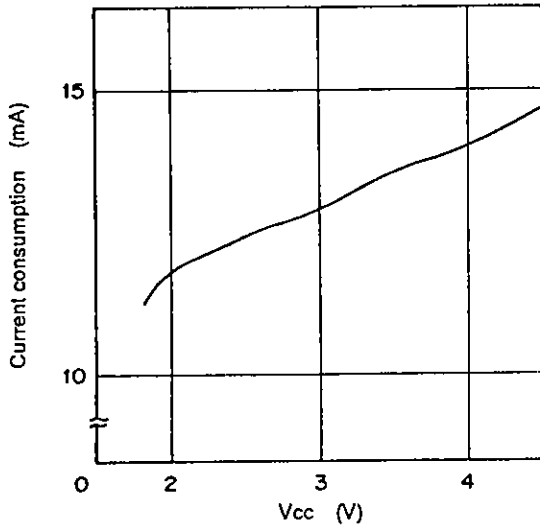
Examples of Representative Characteristics

Maximum output vs. Vcc characteristics (8 Ω load)  
(fo=1kHz, THD=10%, RL=8 Ω)

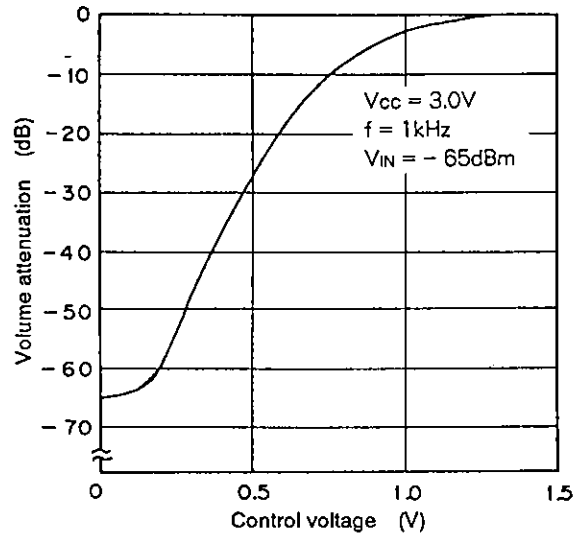


Examples of Representative Characteristics

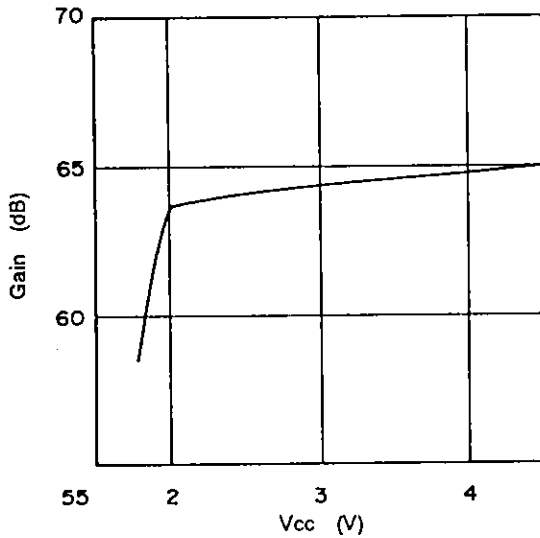
Circuit current (at no signal)



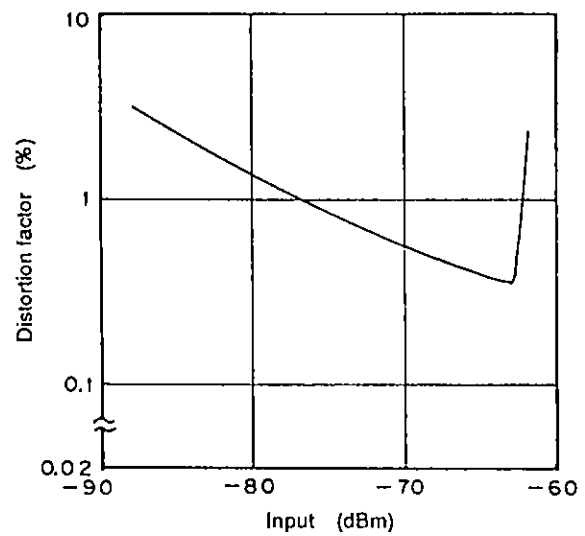
Volume attenuation vs. Control voltage characteristics



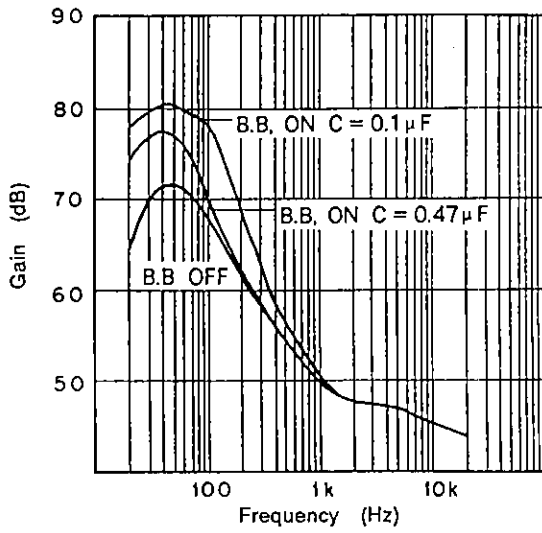
Gain vs. Vcc characteristics  
( $V_{IN} = -75dBm, f = 1kHz$ )



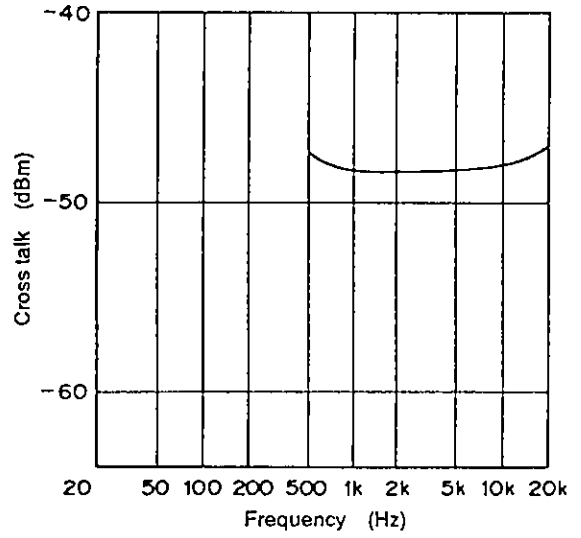
Distortion factor vs. Input characteristics  
( $V_{cc} = 3V, f = 1kHz$ )



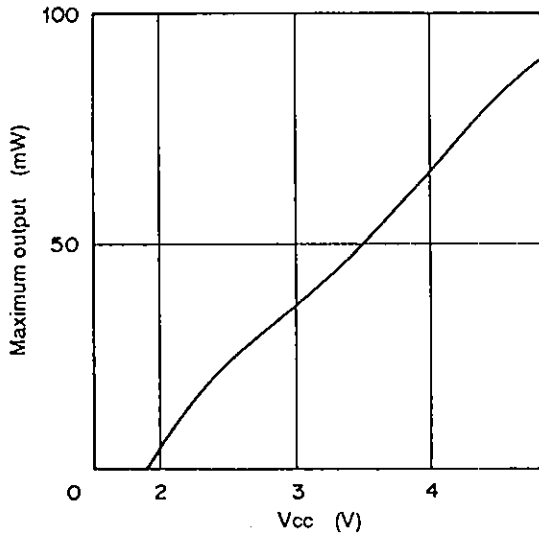
**CXA1635M Frequency Response**  
( $V_{CC}=3V$ ,  $V_{IN}=-75dBm$ ,  $V_{OL}:40\%$ )



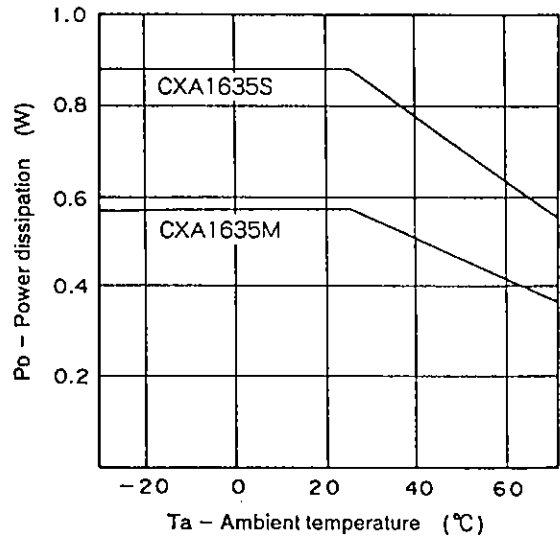
**Channel cross talk vs. Frequency characteristic**  
( $V_{CC}=3V$ ,  $V_{IN}=-65dBm$ ,  $V_{OL}=max.$ )



**Maximum output vs.  $V_{CC}$  characteristic**  
( $f=1kHz$ ,  $THD=10\%$ ,  $R_L=32\Omega$ )

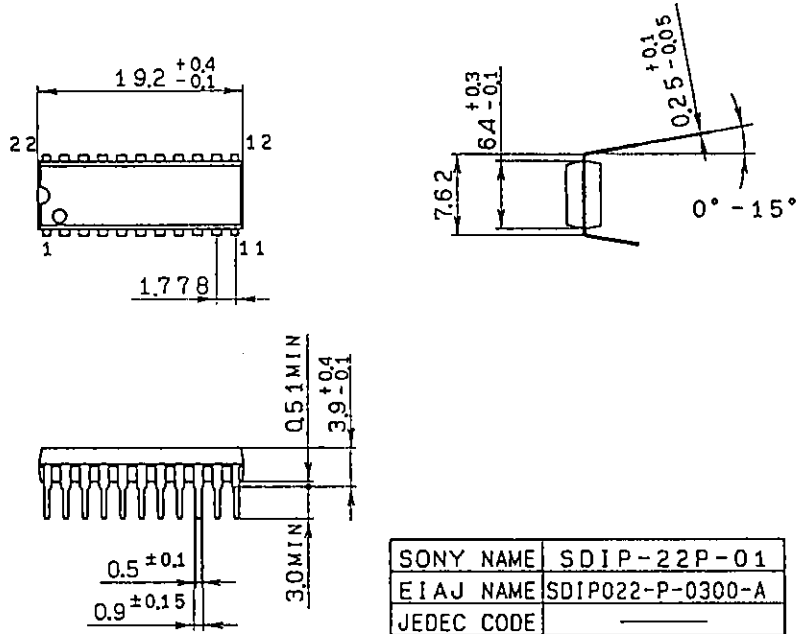


**Power dissipation vs. Ambient temperature**

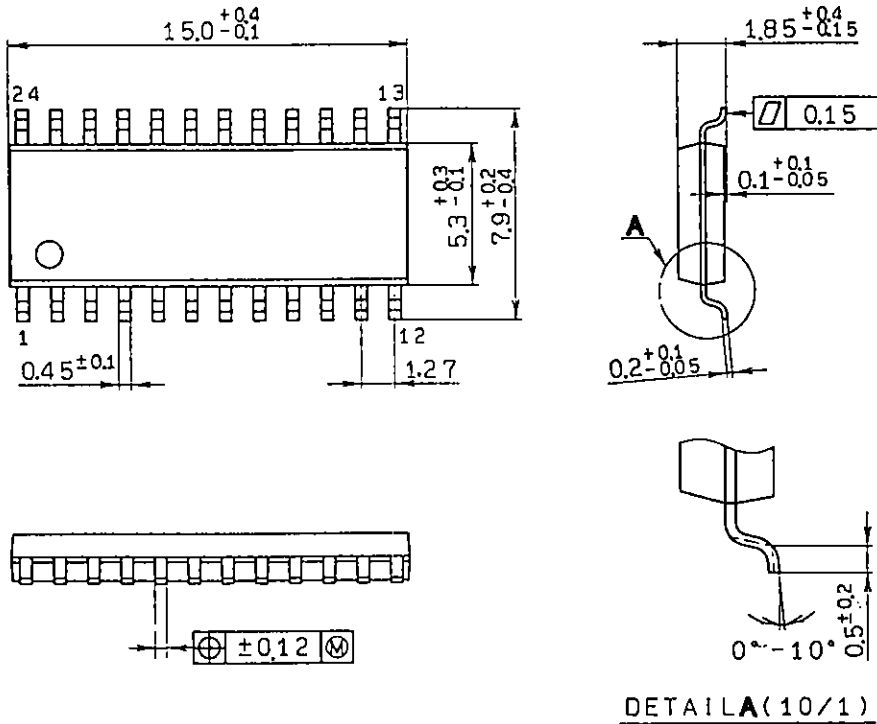


Package Outline Unit : mm

CXA1635S 22pin SDIP (Plastic) 300mil



CXA1635M 24pin SOP (Plastic) 300mil 0.3g



|            |                  |
|------------|------------------|
| SONY NAME  | SOP-24P-L01      |
| EIAJ NAME  | *SOP024-P-0300-A |
| JEDEC CODE | —                |