

# AN6230S

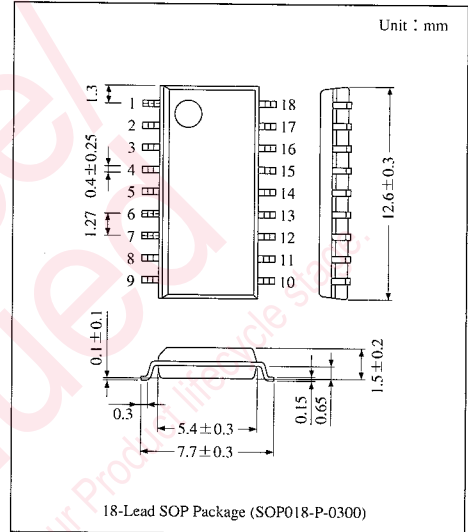
## 450mW Audio Power Amplifier Circuit

### Overview

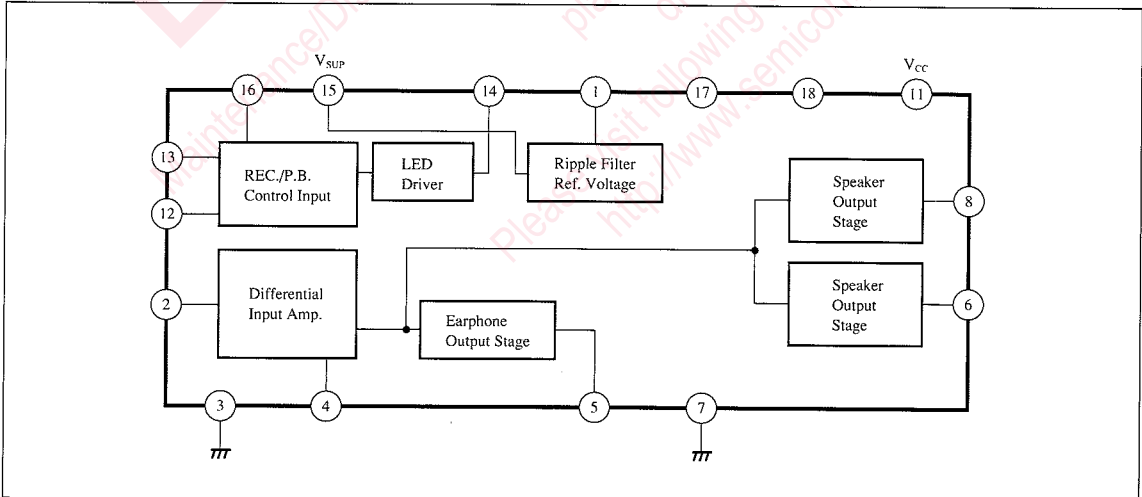
The AN6230S is an integrated circuit designed for power amplifier for 3V operated micro cassette tape recorder and compact cassette deck incorporating speaker amplifier, earphone amplifier and battery checker.

### Features

- High output power
- Low current consumption
- Low ON-OFF shock noise
- Built-in supply voltage check circuit



### Block Diagram



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### ■ Absolute Maximum Ratings (Ta = 25°C)

| Parameter                     | Symbol              | Rating     | Unit |
|-------------------------------|---------------------|------------|------|
| Supply Voltage                | V <sub>CC</sub>     | 6          | V    |
| Supply Current                | I <sub>CC</sub>     | 550        | mA   |
| Power Dissipation *           | P <sub>D</sub>      | 900        | mW   |
| Speaker Amp. Output Current   | I <sub>O(SP)</sub>  | 500        | mA   |
| Earphone Output Current       | I <sub>O(EP)</sub>  | 125        | mA   |
| LED Drive Current             | I <sub>O(LED)</sub> | 10         | mA   |
| Operating Ambient Temperature | T <sub>opr</sub>    | -20 ~ +75  | °C   |
| Storage Temperature           | T <sub>stg</sub>    | -55 ~ +125 | °C   |

\* With a 10cm × 10cm printed circuit board

### ■ Electrical Characteristics (V<sub>CC</sub> = 3V, f = 1kHz, Ta = 25°C)

| Parameter   | Symbol                 | Condition   | min. | typ. | max.                 | Unit |
|---|------------------------|---|------|------|----------------------|------|
| Speaker Amp. Quiescent Circuit Current              | I <sub>CQ1</sub>       |   | 5    | 10   | 15                   | mA   |
| Speaker Amp. Voltage Gain                           | G <sub>VC(SP)</sub>    | f = 1kHz, V <sub>O</sub> = 1V                     | 48.0 | 49.5 | 51.0                 | dB   |
| Speaker Amp. Output Power                           | P <sub>O(SP)</sub>     | f = 1kHz, THD = 10%                               | 400  | 450  | 600                  | mW   |
| Speaker Amp. Total Harmonic Distortion              | THD <sub>(SP)</sub>    | f = 1kHz, P <sub>O</sub> = 100mW                  | —    | 2.0  | 3.0                  | %    |
| Speaker Amp. Output Noise Voltage                   | V <sub>no(SP)</sub>    | R <sub>g</sub> = 0Ω, DIN AUDIO                    | —    | 0.2  | 0.5                  | mV   |
| Earphone Amp. Quiescent Circuit Current             | I <sub>CQ2</sub>       |   | 3    | 7    | 8.5                  | mA   |
| Earphone Amp. Voltage Gain                          | G <sub>VC(EP)</sub>    | f = 1kHz, V <sub>O</sub> = 0.1V                   | 28.5 | 30.0 | 31.5                 | dB   |
| Earphone Amp. Output Power                          | P <sub>O(EP)</sub>     | f = 1kHz, THD = 10%                               | 8    | 11   | —                    | mW   |
| Earphone Amp. Output Noise Voltage                  | V <sub>no(EP)</sub>    | R <sub>g</sub> = 0Ω, DIN AUDIO                    | —    | 0.03 | 0.07                 | mV   |
| Battery Check ON Voltage                            | V <sub>iHL</sub>       | REC. Mode, V <sub>CC</sub> : 0V → V <sub>CC</sub> | 2.3  | 2.4  | 2.5                  | V    |
| Battery Check OFF Voltage                           | V <sub>iLH</sub>       | REC. Mode, V <sub>CC</sub> : 2.4V → 0V            | 1.98 | 2.08 | 2.18                 | V    |
| Earphone/Speaker Switching Voltage (Speaker)        | V <sub>i3(SP)</sub>    |   | 1    | —    | V <sub>SUP-0.3</sub> | V    |
| Earphone/Speaker Switching Voltage (Earphone)       | V <sub>i3(EP)</sub>    |   | 0    | —    | 0.3                  | V    |
| Playback Input Voltage                              | V <sub>i2</sub>        |   | 1.4  | —    | V <sub>SUP</sub>     | V    |
| LED Drive Current                                   | I <sub>SINK14</sub>    | V <sub>14</sub> = 1.3V, V <sub>16</sub> = 1.2V    | 2    | 4    | —                    | mA   |
| DC Offset Voltage of Speaker Amp.                   | V <sub>O(offset)</sub> |   | -35  | 0    | 35                   | mV   |
| Rec./Playback Control Voltage PLAY → MUTE           | V <sub>i(P/M)</sub>    |   | 0.16 | 0.20 | 0.24                 | V    |
| Rec./Playback Control Voltage MUTE → REC.           | V <sub>i(M/R)</sub>    |   | 0.75 | 0.95 | 1.15                 | V    |
| Rec./Playback Control Voltage REC. → MUTE           | V <sub>i(R/M)</sub>    |   | 0.70 | 0.90 | 1.10                 | V    |
| Rec./Playback Control Voltage MUTE → PLAY           | V <sub>i(M/P)</sub>    |   | 0.12 | 0.15 | 0.18                 | V    |
| Rec. Mode Quiescent Current                         | I <sub>CQ3</sub>       | V <sub>i3</sub> = Open                            | —    | 3.0  | 4.0                  | mA   |
| Quiescent Current at the Output Stage (muting mode) | I <sub>CQ4</sub>       |   | —    | 200  | 300                  | μA   |
| Earphone Amp. Total Harmonic Distortion             | THD <sub>(EP)</sub>    | f = 1kHz, V <sub>O</sub> = 0.155V                 | —    | 1.5  | 3                    | %    |
| Speaker Amp. Gain at Decreased Voltage              | G <sub>V(SP2)</sub>    | f = 1kHz, V <sub>i</sub> = -60dBV                 | 41   | 46   | —                    | dB   |
| Ripple Rejection Ratio                              | RR                     | f = 100kHz, R <sub>g</sub> = 0Ω                   | 50   | 65   | —                    | dB   |

## Operational Description

1. This IC incorporates voltage amp. for amplifying voltage, speaker amp. 1, 2, earphone amp., battery checker and LED driver, speaker/earphone switching circuit, control logic circuit at amps., low ripple supply source, click sound protector at power ON.

2. Voltage amplifier

Consists of  $V_1$  (Pin②), NF (Pin④), and gain is determined by grounding Pin④ (Example  $C=6.8\mu\text{F}$ , circuit gain 31dB) AC wise.

3. Speaker amplifier 1.2

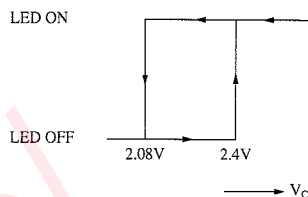
BTL amp. consists of speaker amp. 1 and 2. SP out 1 (Pin⑥) is a non-inverting output and SP out 2 (Pin⑧) is inverting output. Gain from  $V_1$  (Pin②) is 49dB when  $8\Omega$  is connected between SP out and SP out 2. Capacitor between SP out 1, 2 and GND is for the protection of oscillation.

4. Earphone amplifier

Earphone amp. is a OTL amp. Gain is  $-2\text{dB}$  when coupling capacitor is  $100\mu\text{F}$  and load is  $8\Omega$ . Gain from  $V_1$  (Pin②) is 29dB.

5. Battery checker

It checks whether  $V_{CC}$  is normal voltage or not, at REC mode (Pin⑩ is set to 1.1V). At REC mode, LED turns on  $V_{CC}$  is more than 2.4V. LED turns off when  $V_{CC}$  becomes less than 2.1V. Hysteresis width is 0.32V and protects error operation of power supply fluctuation.



6. Speaker/earphone amplifiers switching circuit

This circuit makes to operator either speaker or earphone amp. When Pin⑬ is OPEN, speaker amp. operates. When Pin⑬ is set to GND, earphone amp. operates.

| Pin⑬ | Speaker/Earphone |
|------|------------------|
| OPEN | Speaker          |
| GND  | Earphone         |

7. Amplifier control logic circuit

Operating of speaker and earphone amp. is controlled by DC current of the Pin⑩.

| Voltage at Pin⑩ | Pin⑬ | Speaker | Earphone |
|-----------------|------|---------|----------|
| 0V~0.15V        | OPEN | ○       | ×        |
|                 | GND  | ×       | ○        |
| 0.25V~0.7V      | OPEN | ×       | ×        |
|                 | GND  | ×       | ×        |
| 1.2V~ $V_{CC}$  | OPEN | ×       | ×        |
|                 | GND  | ×       | ○        |

## Pin Descriptions

| Pin No. | Pin Name           | Pin No. | Pin Name                   |
|---------|--------------------|---------|----------------------------|
| 1       | Ripple Filter      | 10      | NC                         |
| 2       | Input              | 11      | Output Stage ; $V_{CC}$    |
| 3       | GND                | 12      | P.B. Only Control Input    |
| 4       | Feedback Input     | 13      | SP/EP Switching Input      |
| 5       | Earphone Output    | 14      | LED Output                 |
| 6       | Speaker Output (1) | 15      | Pre-Amp. ; $V_{SUP}$       |
| 7       | GND                | 16      | Rec./P.B. Control Input    |
| 8       | Speaker Output (2) | 17      | Microphone ; $V_{CC}$      |
| 9       | NC                 | 18      | Battery Check Voltage Adj. |

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