

# AN7208SA

TV/FM front-end IC for 1.5 V headphone stereo

## Overview

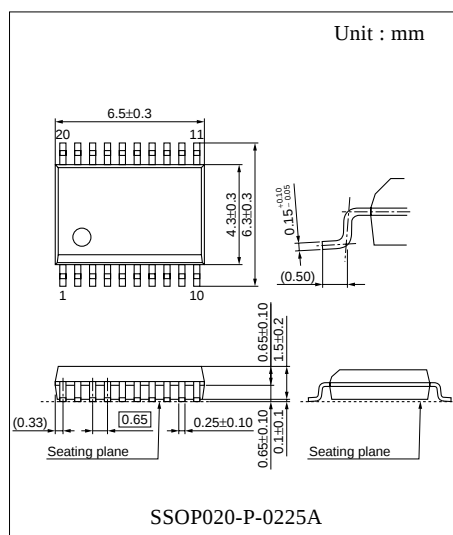
The AN7208SA is a TV/ FM front-end IC developed for use in the headphone stereo. It incorporates two systems of FM and VHF band front-end. A pre-amp. between IF amp. is not necessary by combination with the AN7233SH.

## Features

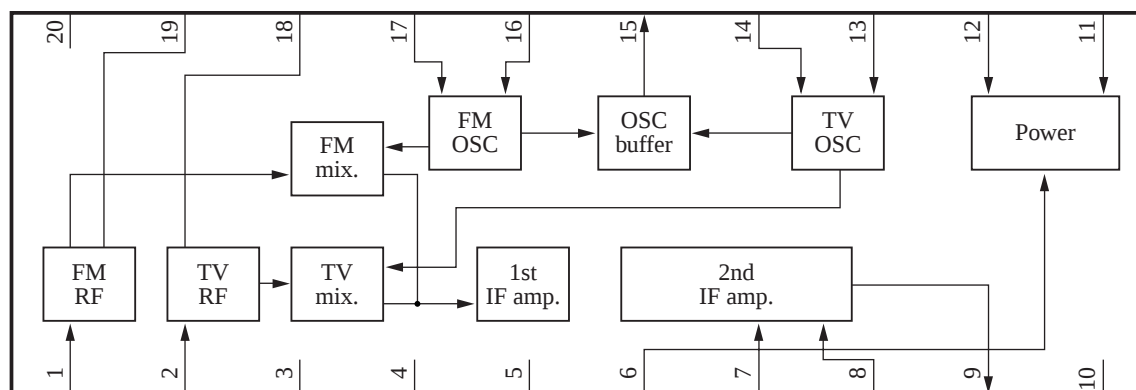
- Built-in two system of FM and VHF band front-end
- Pre-amp. between IF amp. is not necessary (combination with the AN7233SH)
- Built-in standby /IF gain control/local oscillator buffer circuits

## Applications

- 1.5 V headphone stereo ( $V_{CC}$  1.0 V to 2.0 V)



## Block Diagram



## ■ Pin Descriptions

| Pin No. | Description     | Pin No. | Description      |
|---------|-----------------|---------|------------------|
| 1       | FM RF input     | 11      | V <sub>CC2</sub> |
| 2       | TV RF input     | 12      | STDBY            |
| 3       | GND 1           | 13      | TV OSC 1         |
| 4       | N.C.            | 14      | TV OSC 2         |
| 5       | IF out 1        | 15      | OSC buff.        |
| 6       | Mode SW         | 16      | FM OSC 1         |
| 7       | IF in           | 17      | FM OSC 2         |
| 8       | IF gain control | 18      | TV RF            |
| 9       | IF out 2        | 19      | FM RF            |
| 10      | GND 2           | 20      | V <sub>CC1</sub> |

## ■ Absolute Maximum Ratings

| Parameter                        | Symbol           | Rating      | Unit |
|----------------------------------|------------------|-------------|------|
| Supply voltage                   | V <sub>CC</sub>  | 2.5         | V    |
| Supply current                   | I <sub>CC</sub>  | 12          | mA   |
| Power dissipation                | P <sub>D</sub>   | 30          | mW   |
| Operating ambient temperature *1 | T <sub>opr</sub> | −20 to +75  | °C   |
| Storage temperature *1           | T <sub>stg</sub> | −55 to +125 | °C   |

Note) \*1 : All items are at T<sub>a</sub> = 25°C, except for the operating ambient temperature and storage temperature.

## ■ Recommended Operating Range

| Parameter      | Symbol          | Range      | Unit |
|----------------|-----------------|------------|------|
| Supply voltage | V <sub>CC</sub> | 1.0 to 2.0 | V    |

## ■ Electrical Characteristics at V<sub>CC</sub> = 1.2 V, T<sub>a</sub> = 25°C

| Parameter                       | Symbol                | Conditions                             | Min | Typ | Max | Unit    |
|---------------------------------|-----------------------|----------------------------------------|-----|-----|-----|---------|
| TV f <sub>IN</sub> = 221.75 MHz |                       |                                        |     |     |     |         |
| Conversion gain *1              | G <sub>CONV(TV)</sub> | f <sub>OUT</sub> = 10.6 MHz            | 30  | 38  | 46  | dB      |
| Oscillation voltage             | V <sub>OSC(TV)</sub>  | V <sub>CC</sub> = 0.95 V               | 15  | 27  | —   | mV[rms] |
| S/N *2                          | S/N(TV)               | Input level = 60 dBμ<br>1 kHz 30% Mod. | 41  | 44  | —   | dB      |
| Quiescent current               | I <sub>TOT(TV)</sub>  | —                                      | —   | 8.8 | 12  | mA      |
| Oscillation buffer output       | V <sub>BUF(TV)</sub>  | V <sub>CC</sub> = 0.95 V               | 39  | 62  | —   | mV[rms] |

Note) Tuning is taken the peak point at 10.6 MHz output level ( V<sub>IN</sub> = 30 dBμ, non-modulation)

\*1 : Conversion gain = 20 Log( ΔV (μV) ÷ 31.6)

ΔV is the output difference at V<sub>IN</sub> = 30 dBμ and at V<sub>IN</sub> = 36 dBμ

\*2 : Measurement is done at the detection output of the AN7233

Measure the ratio of output at f<sub>DIV</sub> = 22.5 kHz to that at f<sub>DIV</sub> = 0 Hz (modulation freq. 1 kHz)

**■ Electrical Characteristics at  $V_{CC} = 1.2\text{ V}$ ,  $T_a = 25^\circ\text{C}$  (continued)**

| Parameter                                   | Symbol         | Conditions                                  | Min  | Typ | Max | Unit    |
|---------------------------------------------|----------------|---------------------------------------------|------|-----|-----|---------|
| TV $f_{IN} = 221.75\text{ MHz}$ (continued) |                |                                             |      |     |     |         |
| Burst noise *3                              | $V_{NO(TV)}$   | Input level = 60 dB $\mu$<br>Non-modulation | -1.8 | —   | 1.8 | mV[p-0] |
| FM $f_{IN} = 107.88\text{ MHz}$             |                |                                             |      |     |     |         |
| Conversion gain *1                          | $G_{CONV(FM)}$ | $f_{OUT} = 10.6\text{ MHz}$                 | 30   | 38  | 46  | dB      |
| Oscillation voltage                         | $V_{OSC(FM)}$  | $V_{CC} = 0.95\text{ V}$                    | 40   | 63  | —   | mV[rms] |
| S/N *2                                      | $S/N_{(FM)}$   | Input level = 60 dB $\mu$<br>1 kHz 30% mod. | 48   | 51  | —   | dB      |
| Quiescent current                           | $I_{TOT(FM)}$  | —                                           | —    | 7.7 | 10  | mA      |
| Oscillation buffer output                   | $V_{BUF(FM)}$  | $V_{CC} = 0.95\text{ V}$                    | 66   | 132 | —   | mV[rms] |
| Burst noise *3                              | $V_{NO(FM)}$   | Input level = 60 dB $\mu$<br>Non-modulation | -1.8 | —   | 1.8 | mV[p-0] |

Note) Tuning is taken the peak point at 10.6 MHz output level (  $V_{IN} = 30\text{ dB}\mu$ , non-modulation)

\*1 : Conversion gain =  $20 \text{ Log}(\Delta V (\mu\text{V}) \div 31.6)$

$\Delta V$  is the output difference at  $V_{IN} = 30\text{ dB}\mu$  and at  $V_{IN} = 36\text{ dB}\mu$

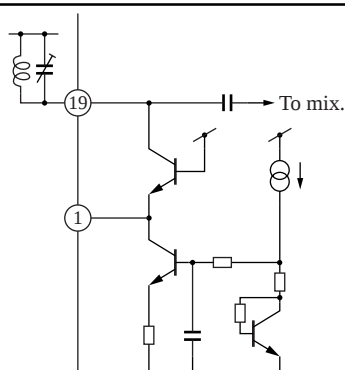
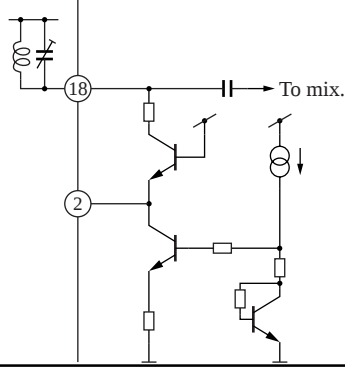
\*2 : Measurement is done at the detection output of the AN7233

Measure the ratio of output at  $f_{DIV} = 22.5\text{ kHz}$  to that at  $f_{DIV} = 0\text{ Hz}$  (modulation freq. 1 kHz)

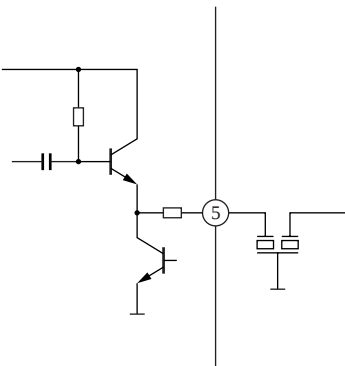
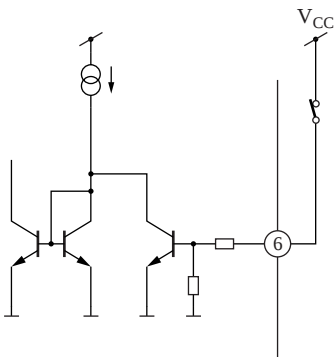
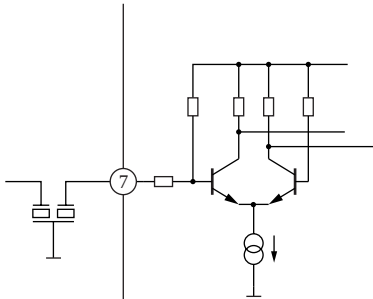
\*3 : Measurement is done at the detection output of the AN7233

Measures a peak voltage of the measurement time = within 500 ms (OK to 10 times)

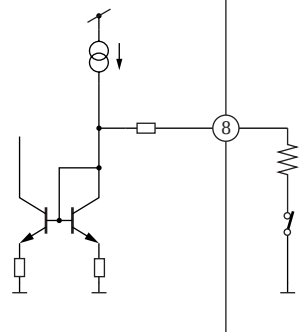
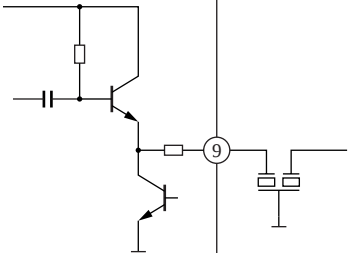
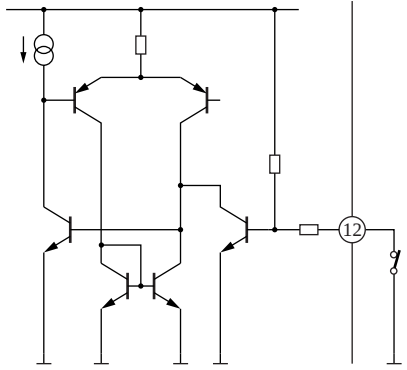
**■ Terminal Equivalent Circuits**

| Pin No. | Equivalent circuit                                                                  | Description                                                         | Input resistance or pin voltage |
|---------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------|---------------------------------|
| 1       |  | FM RF input<br><br>RF signal input in FM band<br>(Common base type) | Approx. $V_{CC} - 0.7\text{ V}$ |
| 2       |  | TV RF input<br><br>RF signal input in TV band<br>(Common base type) | Approx. $V_{CC} - 0.7\text{ V}$ |

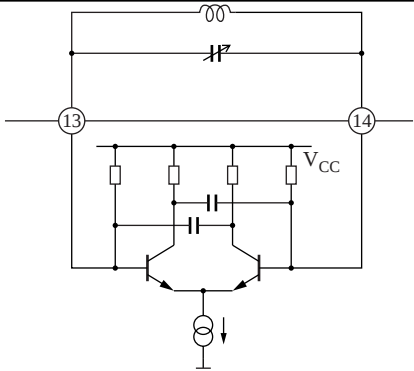
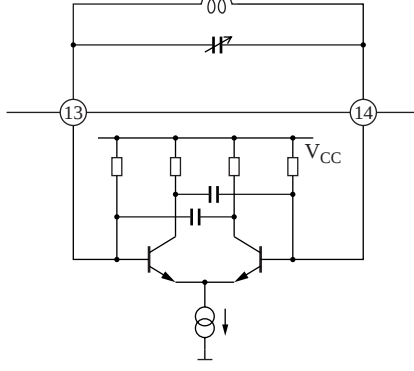
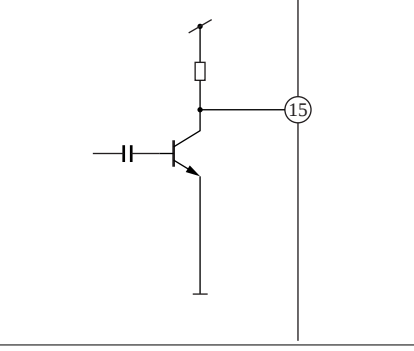
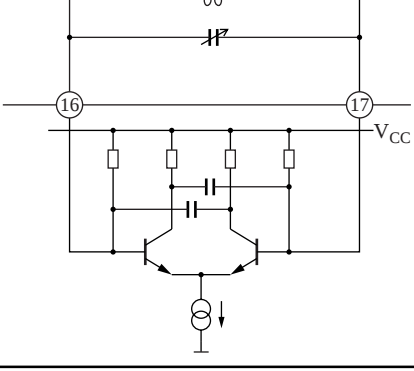
# ■ Terminal Equivalent Circuits (continued)

| Pin No. | Equivalent circuit                                                                  | Description                                                                         | Input resistance or pin voltage                           |
|---------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-----------------------------------------------------------|
| 3       | —                                                                                   | GND 1<br><br>GND pin<br>(RF, mix. block)                                            | —                                                         |
| 4       | —                                                                                   | N.C.                                                                                | —                                                         |
| 5       |    | IF out 1<br><br>Outputs IF signal of TV/FM                                          | Approx. $330\ \Omega$<br>Approx. $V_{CC} - 0.7\ \text{V}$ |
| 6       |   | Mode SW<br><br>Switch of band switching<br>$V_{CC}$ : TV mode<br>Open/GND : FM mode | —                                                         |
| 7       |  | IF in<br><br>IF amp. block input                                                    | Approx. $5\ \text{k}\Omega$                               |

■ Terminal Equivalent Circuits (continued)

| Pin No. | Equivalent circuit                                                                  | Description                                                                                  | Input resistance or pin voltage                  |
|---------|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|--------------------------------------------------|
| 8       |    | IF gain control<br><br>IF amp. block gain can be decreased by inserting a resistance to GND. | Approx. 700 $\Omega$<br>Approx. 0.7 V            |
| 9       |    | IF out 2<br><br>IF amp. block output                                                         | Approx. 330 $\Omega$<br>Approx. $V_{CC} - 0.7$ V |
| 10      | —                                                                                   | GND<br><br>GND pin<br>(IF, OSC block)                                                        | —                                                |
| 11      | —                                                                                   | $V_{CC2}$<br><br>Power supply pin<br>(IF, OSC block)                                         | —                                                |
| 12      |  | STDBY<br><br>Standby switch<br>$V_{CC}$ /open : IC off<br>GND : IC operates                  | —                                                |

# ■ Terminal Equivalent Circuits (continued)

| Pin No. | Equivalent circuit                                                                  | Description                                                 | Input resistance or pin voltage                  |
|---------|-------------------------------------------------------------------------------------|-------------------------------------------------------------|--------------------------------------------------|
| 13      |    | TV OSC 1<br><br>Connects a local oscillator coil of TV band | Approx. 10 k $\Omega$<br>Approx. $V_{CC}$        |
| 14      |   | TV OSC 2<br><br>Connects a local oscillator coil of TV band | Approx. 10 k $\Omega$<br>Approx. $V_{CC}$        |
| 15      |  | OSC buff.<br><br>Oscillator buffer output pin               | Approx. 150 $\Omega$<br>Approx. $V_{CC} - 0.2$ V |
| 16      |  | FM OSC 1<br><br>Connects a local oscillator coil of FM band | Approx. 10 k $\Omega$<br>Approx. $V_{CC}$        |

# ■ Terminal Equivalent Circuits (continued)

| Pin No. | Equivalent circuit | Description                                                 | Input resistance or pin voltage   |
|---------|--------------------|-------------------------------------------------------------|-----------------------------------|
| 17      |                    | FM OSC 2<br><br>Connects a local oscillator coil of FM band | Approx. 10 kΩ<br>Approx. $V_{CC}$ |
| 18      |                    | TV RF<br><br>Connects an RF tuning coil of TV band          | —                                 |
| 19      |                    | FM RF<br><br>Connects an RF tuning coil of FM band          | —                                 |
| 20      | —                  | $V_{CC1}$<br><br>Power supply pin<br>(RF, mix.block)        | —                                 |

# Application Circuit Example

