

# AM radio / FM IF stereo system IC

## BA1448S / BA1449F

The BA1448S and BA1449F are electronic tuning system ICs for AM, FM IF, and MPX. They have been developed for use in radio cassette players and mini-component stereo systems.

The FM detector and MPX VCO circuits do not require adjustment, which will reduce the number of assembly line processes. In particular, the VCO is laser locked, and requires no adjustment or external components. The characteristics of the two chips are the same, but the packages are different (24-pin SDIP for the BA1448S and 24-pin SOP for the BA1449F).

### ●Applications

Synthesized tuners in radio cassette players and mini-component stereo systems.

### ●Features

- 1) Built-in mono AM radio, FM IF amplifier/detector, and FM stereo demodulator.
- 2) DTS compatible (both SD and IF count).
- 3) Built-in reference voltage supply for good short-wave band frequency stability.
- 4) Good FM stability.
- 5) FM detector does not require adjustment (ceramic discriminator).
- 6) FM MPX VCO is laser locked and requires no adjustment or external components.
- 7) Built-in forced monaural function for the MPX (VCO stops, LED off).
- 8) Audio can be low-cut to improve AM fidelity.
- 9) VCO for the MPX switches off during AM operation.
- 10) Mute possible for IF request.

### ●Absolute maximum ratings (Ta = 25°C)

| Parameter             | Symbol           | Limits   | Unit  |
|-----------------------|------------------|----------|-------|
| Power supply voltage  | V <sub>CC</sub>  | 9.0      | V     |
| Power dissipation     | BA1448S          | Pd       | mW    |
|                       | BA1449F          |          |       |
|                       |                  |          | 450*2 |
| Operating temperature | T <sub>opr</sub> | -25~+75  | °C    |
| Storage temperature   | T <sub>stg</sub> | -55~+125 | °C    |

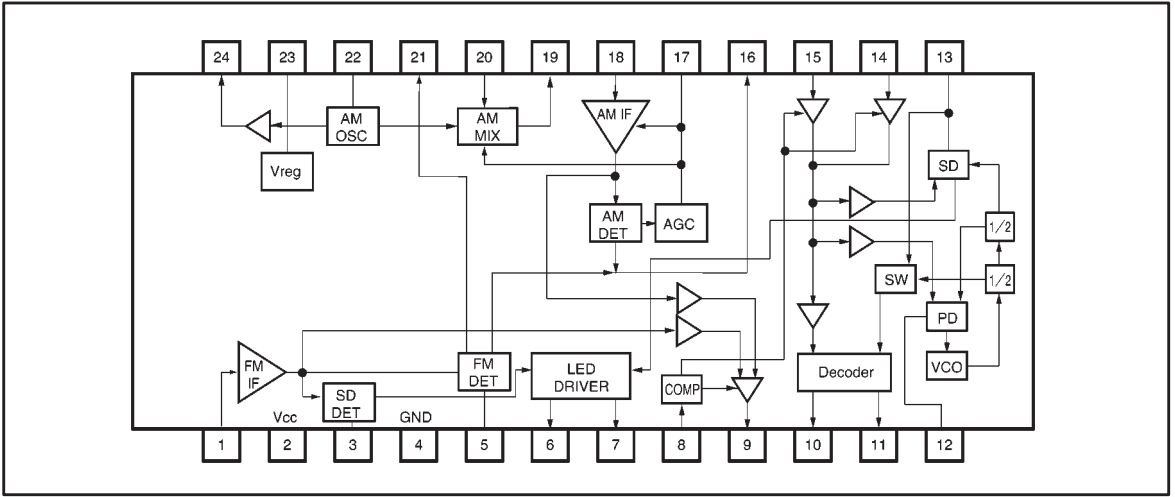
\*1 Reduced by 6.0mW for each increase in Ta of 1°C over 25°C.

\*2 Reduced by 4.5mW for each increase in Ta of 1°C over 25°C.

### ●Recommended operating conditions (Ta = 25°C)

| Parameter            | Symbol          | Min. | Typ. | Max. | Unit |
|----------------------|-----------------|------|------|------|------|
| Power supply voltage | V <sub>CC</sub> | 3.8  | 5.0  | 8.0  | V    |

● Block diagram



● Input/output circuits

| Pin No. | Function   | Internal circuit | Quiescent pin voltage (V) |     |
|---------|--|------------------|---------------------------|-----|
|         |  |                  | FM                        | AM  |
| 1       | FM IF input<br>Connect to an FM ceramic filter.  |                  | 2.1                       | 2.1 |
| 2       | Vcc  |                  | 5.0                       | 5.0 |
| 3       | FM tuning ON level adjustment<br>It is possible to set the tuning indicator ON level by choosing the value of the resistor connected to GND. |                  | 0.25                      | 0   |
| 4       | GND  |                  | 0                         | 0   |
| 5       | FM discriminator<br>Connect to a ceramic discriminator.  |                  | 3.5                       | 5.0 |
| 6       | Tuning indicator<br>Connect to an LED or tuning indicator device.  |                  | —                         | —   |
| 7       | Stereo indicator<br>Connect to an LED or stereo indicator device.  |                  | —                         | —   |

| Pin No. | Function   | Internal circuit | Quiescent pin voltage (V) |     |
|---------|--|------------------|---------------------------|-----|
|         |  |                  | FM                        | AM  |
| 8       | <ul style="list-style-type: none"> <li>• IF request</li> <li>• IF signal output when 4.0V or more.</li> <li>• MUTE</li> <li>• MUTE on when 2.0V or more.</li> </ul>              |                  | 0                         | 0   |
| 9       | <ul style="list-style-type: none"> <li>• IF output</li> <li>• IF signal output.</li> </ul>   |                  | 4.2                       | 4.2 |
| 10      | R channel output   |                  | 1.5                       | 1.5 |
| 11      | L channel output   |                  | 1.5                       | 1.5 |
| 12      | <ul style="list-style-type: none"> <li>• PLL filter</li> <li>• Connect to a lag/lead filter.</li> <li>• AM/FM band switch</li> <li>• AM mode when connected to GND.</li> </ul>   |                  | 2.1                       | 0   |
| 13      | <ul style="list-style-type: none"> <li>• Forced monaural</li> <li>• Forced monaural when connected to GND.</li> <li>• Pilot filter</li> <li>• Connect to a capacitor.</li> </ul> |                  | 2.1                       | 2.1 |

| Pin No. | Function  | Internal circuit | Quiescent pin voltage (V) |     |
|---------|---|------------------|---------------------------|-----|
|         |   |                  | FM                        | AM  |
| 14      | MPX input<br>Input the FM detector output                         |                  | 2.1                       | 2.1 |
| 15      | MPX input<br>Input the AM detector output after low cut           |                  | 2.1                       | 2.1 |
| 16      | AM/FM detector output<br>Connect to following-stage MPX<br>FM LPF |                  | 2.1                       | 2.1 |
| 17      | AM AGC<br>Connect to a capacitor.                                 |                  | 0                         | 0   |
| 18      | AM IF input<br>Connect to AM ceramic filter.                      |                  | 5.0                       | 5.0 |
| 19      | AM mixer output<br>Connect to AM IFT first stage.                 |                  | 5.0                       | 5.0 |
| 20      | AM antenna<br>Connect to AM antenna.                              |                  | 2.1                       | 2.1 |

| Pin No. | Function  | Internal circuit | Quiescent pin voltage (V) |     |
|---------|---|------------------|---------------------------|-----|
|         |   |                  | FM                        | AM  |
| 21      | FM detector bandwidth adjustment<br>Set the required FM detector bandwidth by adjusting a resistor value connected to the reference voltage source. |                  | 2.1                       | 2.1 |
| 23      | Reference voltage<br>Connect to a capacitor.  | —————            | 2.1                       | 2.1 |
| 22      | AM station oscillator<br>Connect to AM oscillator circuit.  |                  | 2.1                       | 2.1 |
| 24      | AM oscillator output<br>AM oscillator output.   |                  | 1.7                       | 1.4 |

● Electrical characteristics (unless otherwise noted,  $T_a = 25^\circ\text{C}$ ,  $V_{CC} = 5\text{V}$ )  
 Signal source FM IF MPX:  $f_{IN} = 10.7\text{MHz}$ , 1kHz modulation 22.5kHz dev (30%),  
 19kHz modulation 7.5kHz dev (10%)  
 AM :  $f_{IN} = 1000\text{kHz}$ , 1kHz modulation 30%

| Parameter                    | Symbol             | Min. | Typ. | Max. | Unit              | Conditions  |
|------------------------------|--------------------|------|------|------|-------------------|---|
| Quiescent circuit (FM)       | $I_{Q(FM)}$        | 11   | 19   | 29   | mA                | No signal   |
| Quiescent circuit (AM)       | $I_{Q(AM)}$        | 11   | 19   | 29   | mA                | No signal   |
| 〈FM IF MPX〉                  |                    |      |      |      |                   |   |
| Detector output voltage      | $V_O$              | 68   | 90   | 120  | mV <sub>rms</sub> | $V_{IN} = 100\text{dB } \mu\text{V}$ , mono               |
| -3dB limiting sensitivity    | L.S                | 32   | 36   | 40   | dB $\mu\text{V}$  | mono  |
| Signal-to-noise ratio        | S / N              | 62   | 70   | —    | dB                | $V_{IN} = 100\text{dB } \mu\text{V}$ , mono               |
| Channel balance              | C.B                | -2   | 0    | 2    | dB                | $V_{IN} = 100\text{dB } \mu\text{V}$ , mono               |
| AM suppression ratio         | AMR                | 40   | 50   | —    | dB                | AM : $V_{IN} = 60\text{dB } \mu\text{V}$ , mod=30%, 400Hz |
| Channel separation           | SEP                | 35   | 45   | —    | dB                | $V_{IN} = 100\text{dB } \mu\text{V}$ , main               |
| Total harmonic distortion    | THD                | —    | 0.1  | 0.8  | %                 | $V_{IN} = 100\text{dB } \mu\text{V}$ , main               |
| Station detector sensitivity | $SD_s$             | 36   | 43   | 50   | dB $\mu\text{V}$  | Input to make pin 6 current $\geq 1\text{mA}$             |
| Station detector bandwidth   | $SD_{sw}$          | 50   | 100  | 160  | kHz               | $V_{IN} = 100\text{dB } \mu\text{V}$ , mono               |
| IF OUT pin output voltage    | $V_{IF}$           | 300  | 400  | 530  | mV <sub>P-P</sub> | IF request on   |
| 〈AM〉                         |                    |      |      |      |                   |   |
| Detector output voltage      | $V_O$              | 68   | 90   | 120  | mV <sub>rms</sub> | $V_{IN} = 68\text{dB } \mu\text{V}$                       |
| Usable sensitivity           | Q.S                | 21   | 24   | 27   | dB $\mu\text{V}$  | Input to make S/N 20dB                                    |
| Signal-to-noise ratio        | S / N              | 42   | 52   | —    | dB                | $V_{IN} = 68\text{dB } \mu\text{V}$                       |
| Total harmonic distortion    | THD                | —    | 0.6  | 1.8  | %                 | $V_{IN} = 68\text{dB } \mu\text{V}$                       |
| Station detector sensitivity | $SD_s$             | 20   | 27   | 34   | dB $\mu\text{V}$  | Input to make pin 6 current $\geq 1\text{mA}$             |
| IF OUT pin output voltage    | $V_{IF}$           | 300  | 400  | 530  | mV <sub>P-P</sub> | IF request on   |
| Buffer output voltage        | $V_{O\text{Buff}}$ | 140  | 200  | 280  | mV <sub>rms</sub> | —   |

● Measurement circuit

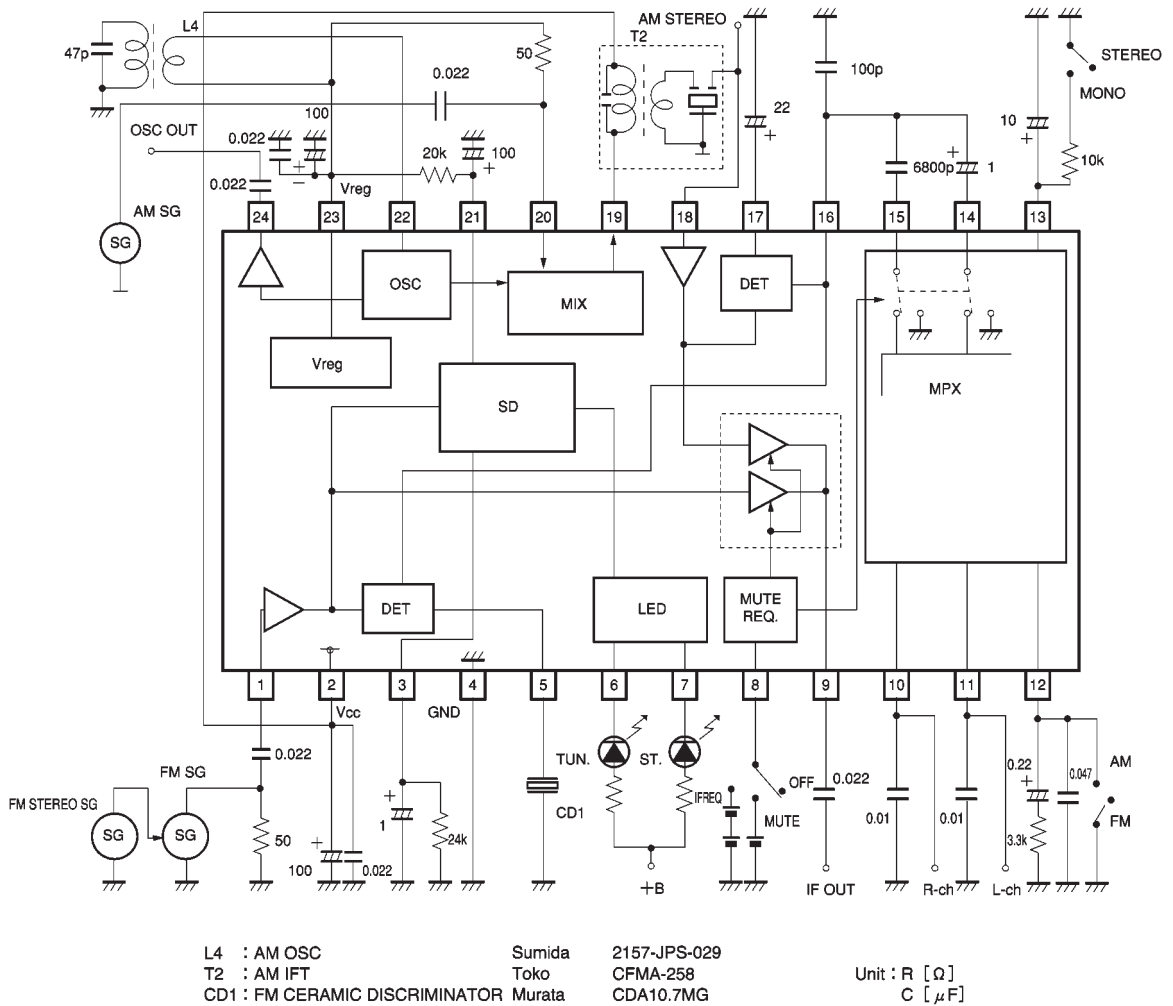


Fig. 1

● Application example

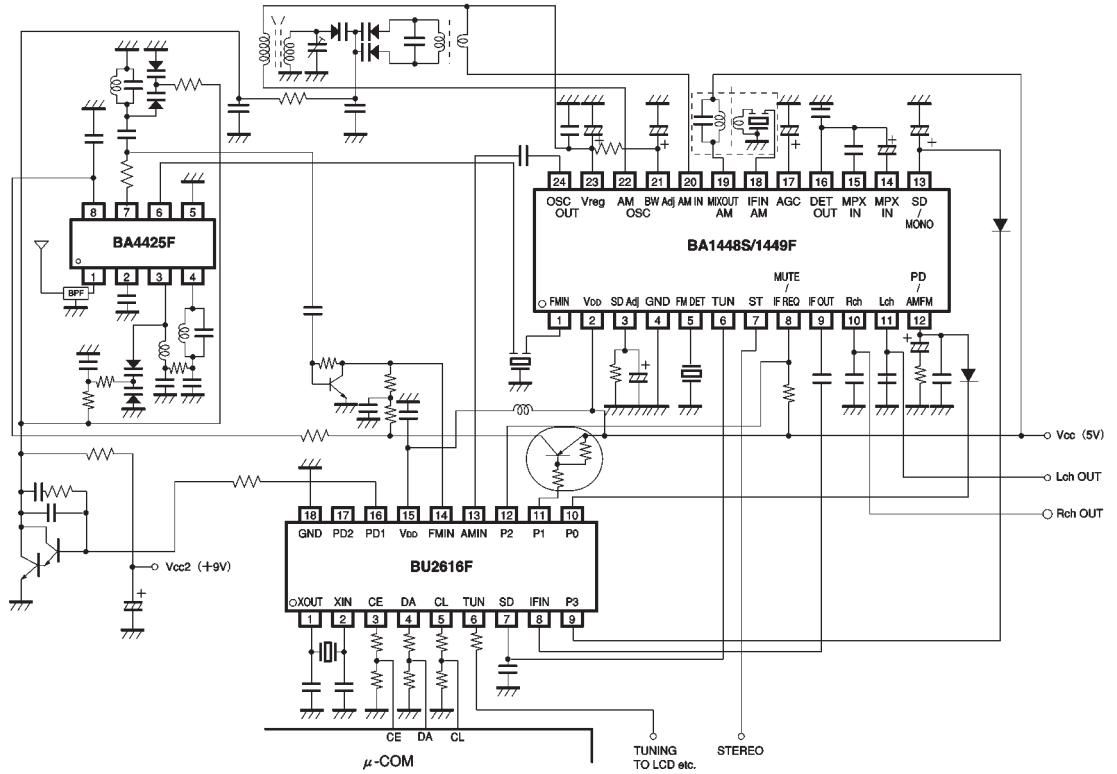


Fig. 2

● Electrical characteristic curves

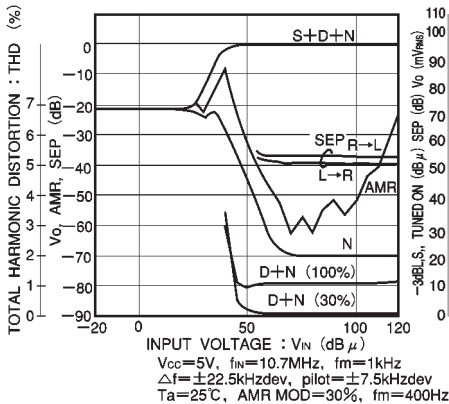


Fig. 3 FM I/O characteristics

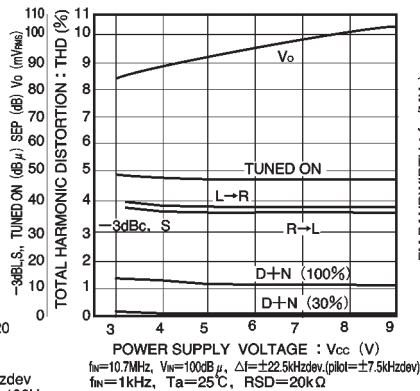


Fig. 4 FM characteristics vs. power supply voltage

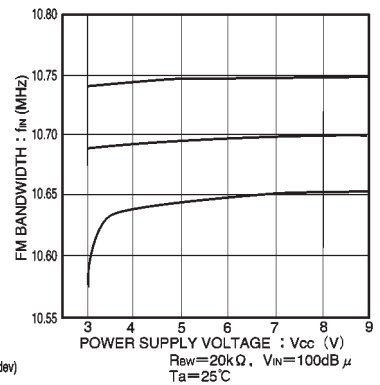


Fig. 5 FM bandwidth vs. power supply voltage



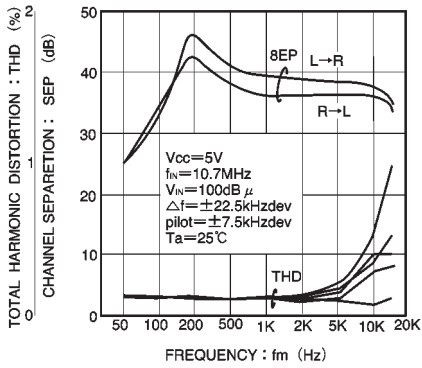


Fig. 6 Frequency vs. FM channel separation and THD

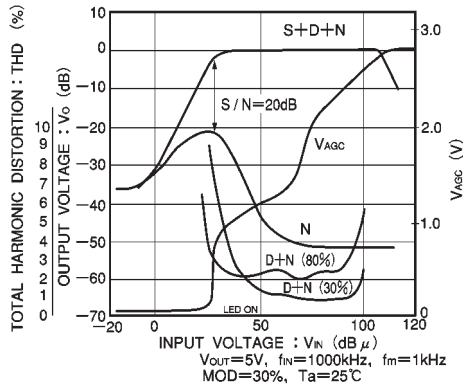


Fig. 7 AM I/O characteristics

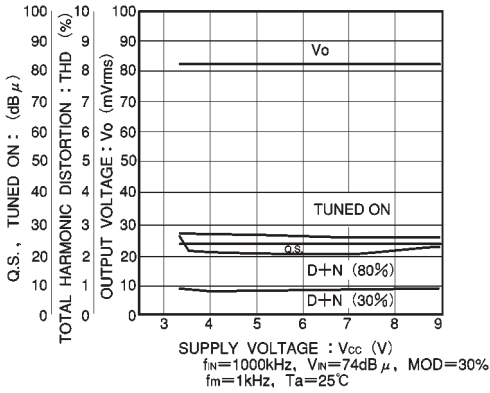


Fig. 8 AM characteristics vs. power supply voltage

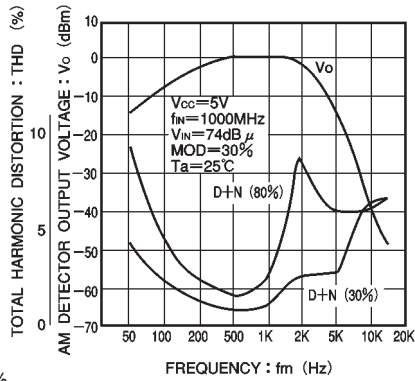


Fig. 9 AM detector output and THD vs. frequency

● External dimensions (Units: mm)

