

# AN7298FBP

FM-IF, NC, and MPX IC for car radio

## ■ Overview

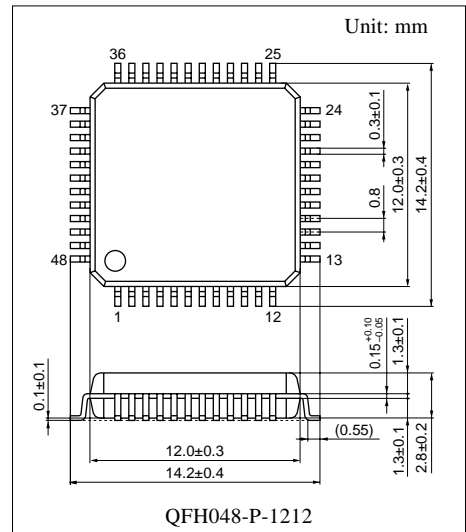
The AN7298FBP is an IC for car radio. The FM-IF, NC (Noise Canceler) and MPX functions are integrated into a single chip. The IC has the higher functions than our conventional IC (AN7292NSC) and the characteristics of multi-pass detection, mute and SD functions are improved.

## ■ Features

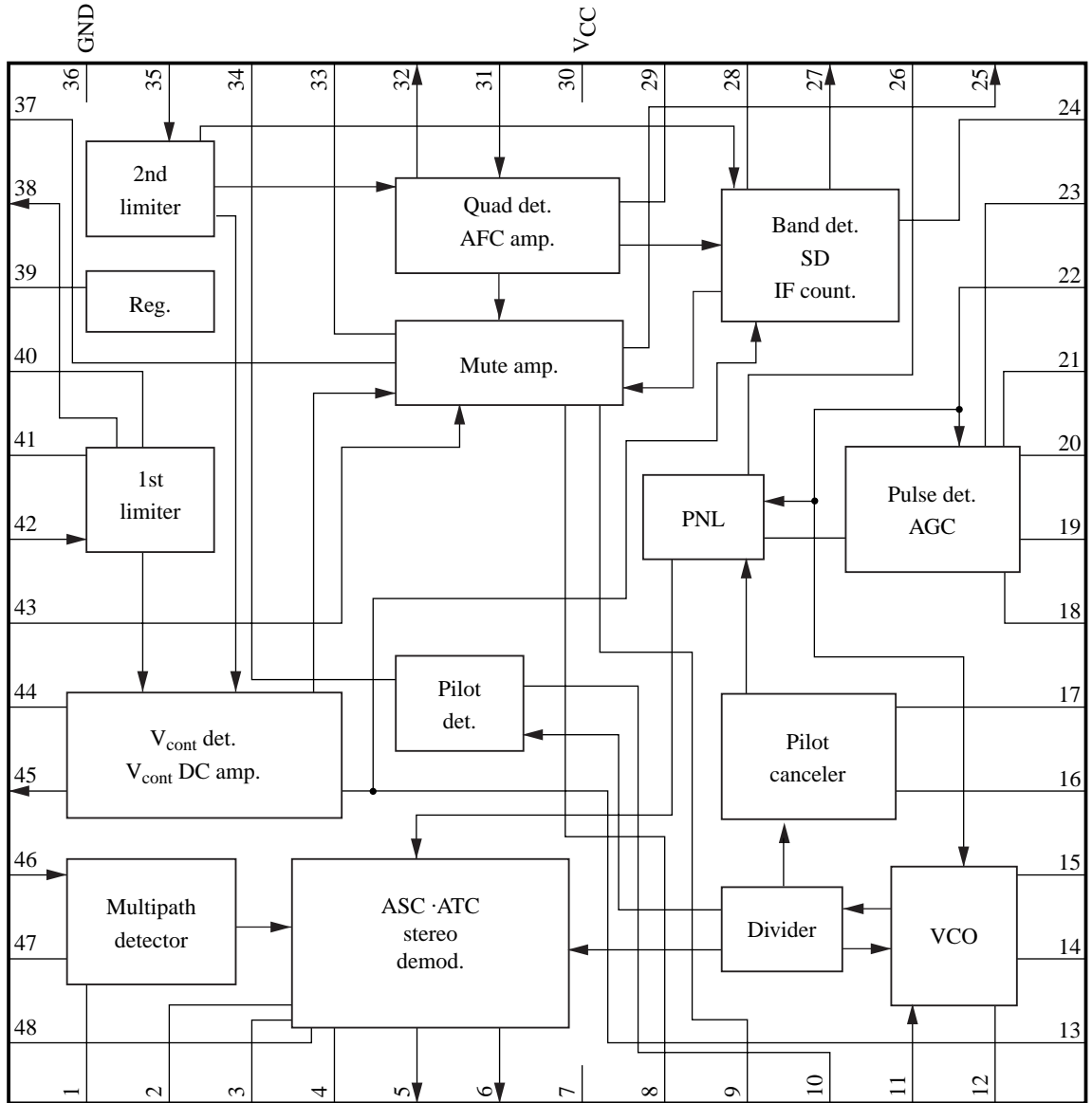
- IF sensitivity is high. (limiting sensitivity 26 dB $\mu$ )
- Adjustment-free VCO (912 kHz)
- Good linearity of S-meter output (adjusting function)

## ■ Applications

- Car radios



■ Block Diagram



### ■ Pin Descriptions

| Pin No. | Description                      | Pin No. | Description                |
|---------|----------------------------------|---------|----------------------------|
| 1       | ASC adjustment                   | 25      | IF detection output        |
| 2       | ATC adjustment                   | 26      | PNL output hold            |
| 3       | Separation adjustment            | 27      | SD/IF counter output       |
| 4       | ATC LPF                          | 28      | SD sensitivity adjustment  |
| 5       | R-ch. output                     | 29      | AFC output                 |
| 6       | L-ch. output                     | 30      | V <sub>CC</sub>            |
| 7       | Control voltage output           | 31      | IF detection coil          |
| 8       | Band mute control                | 32      | Limiter output             |
| 9       | Soft mute filter                 | 33      | Soft mute adjustment       |
| 10      | Phase detection filter1          | 34      | Stereo lamp drive          |
| 11      | Forced monaural                  | 35      | 2nd limiter output         |
| 12      | Phase detection filter 2-1       | 36      | GND                        |
| 13      | SD startup time constant setting | 37      | Mute adjustment            |
| 14      | Phase detection filter 2-2       | 38      | 1st limiter                |
| 15      | VCO                              | 39      | Reference voltage          |
| 16      | Phase detection filter 3         | 40      | 1st limiter output GND     |
| 17      | Pilot canceler negation filter   | 41      | 1st limiter bias           |
| 18      | PNL LPF                          | 42      | IF input                   |
| 19      | PNL LPF                          | 43      | Mute slope adjustment      |
| 20      | PNL gate pulse filter            | 44      | Control voltage adjustment |
| 21      | PNL AGC                          | 45      | Control voltage output     |
| 22      | PNL input                        | 46      | Control voltage input      |
| 23      | PNL HPF                          | 47      | ASC                        |
| 24      | IF-counter output stop           | 48      | Control voltage detection  |

### ■ Absolute Maximum Ratings

| Parameter                        | Symbol           | Rating      | Unit |
|----------------------------------|------------------|-------------|------|
| Supply voltage                   | V <sub>CC</sub>  | 9.7         | V    |
| Supply current                   | I <sub>CC</sub>  | 48          | mA   |
| Power dissipation *2             | P <sub>D</sub>   | 301         | mW   |
| Operating ambient temperature *1 | T <sub>opr</sub> | -30 to +80  | °C   |
| Storage temperature *1           | T <sub>stg</sub> | -55 to +125 | °C   |

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

\*2 : Power dissipation of IC alone at T<sub>a</sub> = 80°C.

### ■ Recommended Operating Range

| Parameter      | Symbol   | Range      | Unit |
|----------------|----------|------------|------|
| Supply voltage | $V_{CC}$ | 7.2 to 9.6 | V    |

### ■ Electrical Characteristics at $V_{CC} = 8\text{ V}$ , $f_{IN} = 10.70\text{ MHz}$ , $f_{mod} = 1\text{ kHz}$ 30%FM, $T_a = 25^\circ\text{C}$

| Parameter              | Symbol              | Conditions  | Min          | Typ         | Max  | Unit     |
|------------------------|---------------------|---|--------------|-------------|------|----------|
| Control voltage 1      | $V_{C1}$            | Without input, pin 45 DC voltage  | 0.05         | 0.50        | 0.90 | V        |
| Control voltage 2      | $V_{C2}$            | $V_{IN} = 40\text{ dB}\mu$ , pin 45 DC voltage                              | 1.20         | 1.65        | 2.10 | V        |
| Control voltage 3      | $V_{C3}$            | $V_{IN} = 70\text{ dB}\mu$ , pin 45 DC voltage                              | 2.75         | 3.45        | 4.15 | V        |
| Control voltage 4      | $V_{C4}$            | $V_{IN} = 100\text{ dB}\mu$ , pin 45 DC voltage                             | 4.45         | 5.35        | 6.25 | V        |
| Control voltage 5      | $V_{C5}$            | $V_{C5} = V_{C3} - V_{C2}$  | 1.60         | 1.80        | 2.00 | V        |
| Control voltage 6      | $V_{C6}$            | $V_{C6} = V_{C4} - V_{C3}$  | 1.70         | 1.90        | 2.10 | V        |
| AFC offset voltage     | $V_{AFC}$           | Without input, DC voltage between pin 29 and pin 39                         | -0.1         | 0.0         | 0.1  | V        |
| Output level L         | $V_{OL}$            | $V_{IN} = 70\text{ dB}\mu$ , pin 6 AC voltage                               | 90           | 110         | 130  | mV[rms]  |
| Output level R         | $V_{OR}$            | $V_{IN} = 70\text{ dB}\mu$ , pin 5 AC voltage                               | 90           | 110         | 130  | mV[rms]  |
| Channel balance        | CB                  | $CB = 20\text{Log}(V_{OL}/V_{OR})$  | -1.0         | 0.0         | 1.0  | dB       |
| Limiting sensitivity   | $V_{lim}$           | $V_{OL}$ to 0 dB. Input when pin 6 AC voltage drops by 3 dB                 | 20.0         | 26          | 30.0 | dB $\mu$ |
| Residual pilot voltage | $V_{PC}$            | Pin 26 output when $V_{IN} = 70\text{ dB}\mu$ , pilot signal 10% modulation | —            | 4           | 14.0 | mV[rms]  |
| Stereo lamp on-level   | Lamp <sub>ON</sub>  | Modulation with pilot signal only, DC voltage of pin 34 is below 2 V        | 1.0          | 3.5         | 6.0  | %        |
| Stereo lamp off-level  | Lamp <sub>OFF</sub> | Modulation with pilot signal only. Ratio of stereo lamp on and off level    | 2.0          | 6.0         | 10.0 | dB       |
| Separation L-ch.       | Sep <sub>L</sub>    | $V_{IN} = 70\text{ dB}\mu$ , L+R = 90% Pilot 10%                            | 25           | 33          | —    | dB       |
| Separation R-ch.       | Sep <sub>R</sub>    | $V_{IN} = 70\text{ dB}\mu$ , L+R = 90% Pilot 10%                            | 25           | 33          | —    | dB       |
| Capture range          | CR                  | $V_{IN} = 70\text{ dB}\mu$ , pilot signal 6.5% modulation                   | +0.6<br>-0.2 | +0.8<br>0.4 | —    | %        |
| Counter output level 1 | $V_{IF1}$           | $V_{IN} = 70\text{ dB}\mu$ , pin 28 = 0V, pin 27 10.7 MHz, output voltage   | 0            | 2.0         | 5.0  | mV[rms]  |
| Counter output level 2 | $V_{IF2}$           | $V_{IN} = 70\text{ dB}\mu$ , pin 28 = $V_{CC}$ , pin 27 AC output voltage   | 85           | 100         | 115  | mV[rms]  |
| Power supply current   | $I_{tot}$           | Without input, pin 11 = 0 V   | 28.0         | 35.0        | 42.0 | mA       |
| Monaural THD (L-ch.)   | THD <sub>L</sub>    | Monaural input 400 mV, 1kHz, L-ch. distortion                               | —            | 0.15        | 0.3  | %        |
| Monaural THD (R-ch.)   | THD <sub>R</sub>    | Monaural input 400 mV, 1kHz, R-ch. distortion                               | —            | 0.15        | 0.3  | %        |

**■ Electrical Characteristics at  $V_{CC} = 8\text{ V}$ ,  $f_{IN} = 10.70\text{ MHz}$ ,  $f_{mod} = 1\text{ kHz}$  30%FM,  $T_a = 25^\circ\text{C}$  (continued)**

| Parameter               | Symbol            | Conditions  | Min | Typ  | Max  | Unit          |
|-------------------------|-------------------|---|-----|------|------|---------------|
| Stereo THD (L-ch.)      | THD <sub>SL</sub> | Stereo, L+R = 360 mV, $V_p = 40\text{ mV}$ ,<br>L-ch. distortion  | —   | 0.15 | 0.3  | %             |
| Stereo THD (R-ch.)      | THD <sub>SR</sub> | Stereo, L+R = 360 mV, $V_p = 40\text{ mV}$ ,<br>R-ch. distortion  | —   | 0.15 | 0.3  | %             |
| AGC voltage 1           | $V_{AGC1}$        | Input = 0, $R_S = 600\ \Omega$ ,<br>pin 21 DC voltage   | —   | 0.0  | 0.4  | V             |
| AGC voltage 2           | $V_{AGC2}$        | Input $V_{IN2} = 2\text{ mV[rms]}$ ,<br>150 kHz, pin 21 DS voltage  | 1.3 | 1.48 | 1.65 | V             |
| Noise detection voltage | $V_{DET}$         | $V_{IN2} = 100\text{ mV[rms]}$ , 150 kHz,<br>pin 20 DC voltage  | —   | 0.0  | 0.3  | V             |
| Gate pulse width        | PW                | $V_{IN2} = 0.3\text{ V[p-p]}$ , $t_w = 1\ \mu\text{s}$ ,<br>$f = 1\text{ kHz}$ , pin 26 output pulse width      | 19  | 24   | 29   | $\mu\text{s}$ |
| Residual noise voltage  | $V_{NR}$          | $V_{IN2} = 1\text{ V[p-p]}$ , $t_w = 10\ \mu\text{s}$ , $f = 1\text{ kHz}$ ,<br>input through LPF, L-ch. output | —   | 0.0  | 1.2  | mV[rms]       |
| SD bandwidth            | SDW               | Bandwidth when SD output (pin<br>27) is over 4.5 V, $V_{28} = 2.7\text{ V}$                                     | 110 | 140  | 170  | kHz           |
| SD sensitivity          | SDS               | Input when SD output (pin 27) is<br>over 4.5 V, $V_{28} = 2.7\text{ V}$   | 45  | 55   | 65   | dB $\mu$      |

■ Application Circuit Example

