

# Second Mixer IF for digital cellular phones

## BH4128FV

The BH4128FV is an IC equipped with internal second mixer and IF amplifier circuits, developed for use with digital cellular phones.

### ●Applications

Digital cellular phones

### ●Features

- 1) Equipped with internal mixer, IF, and RSSI circuits.
- 2) Can be operated at mixer input frequencies ranging from 10MHz to 200MHz.
- 3) IF amplifier gain is 100 dB.
- 4) Equipped with a battery power saving function.

### ●Absolute maximum ratings (Ta = 25 °C, for measurement circuit)

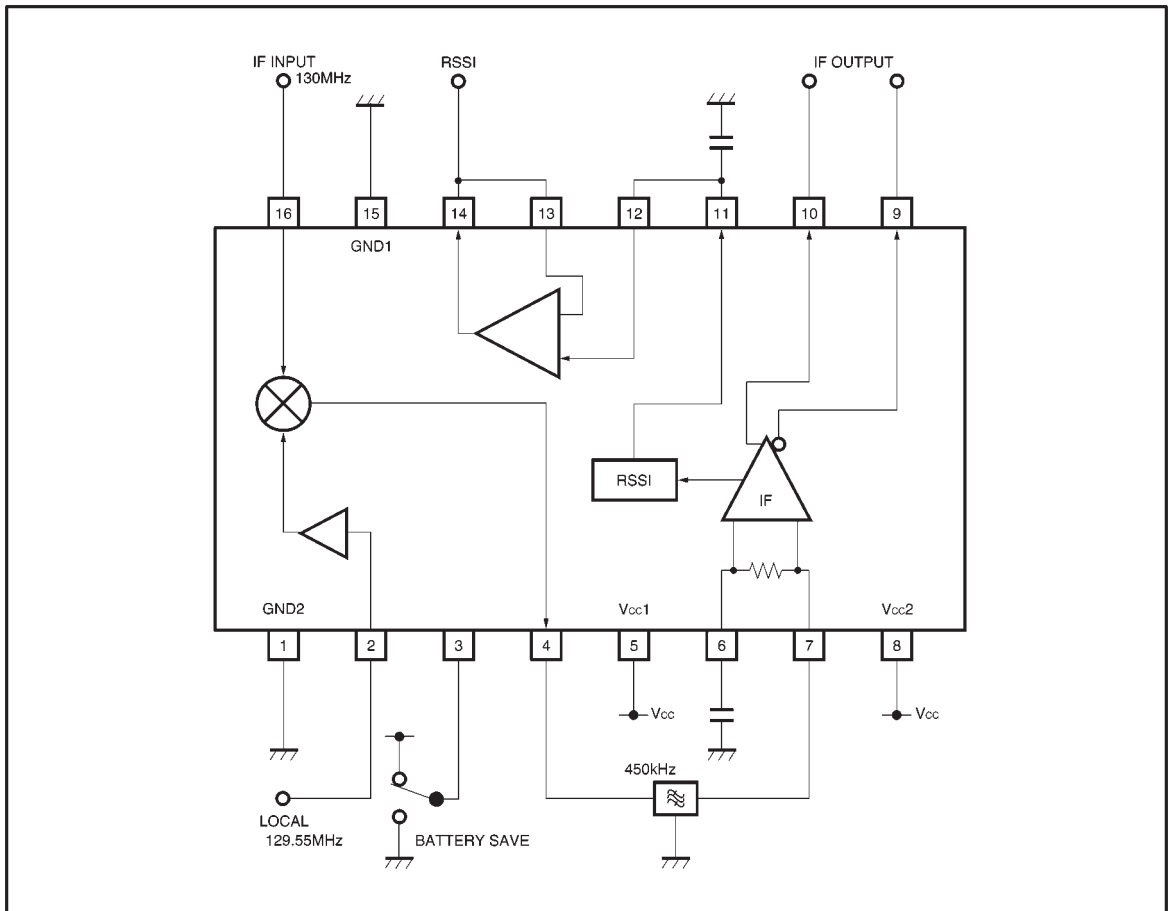
| Parameter            | Symbol           | Limits   | Unit |
|----------------------|------------------|----------|------|
| Power supply voltage | V <sub>cc</sub>  | 7.0      | V    |
| Power dissipation    | P <sub>d</sub>   | 350*     | mW   |
| Storage temperature  | T <sub>stg</sub> | −55~+125 | °C   |

\* Reduced by 3.5mW for each increase in Ta of 1°C over 25°C.

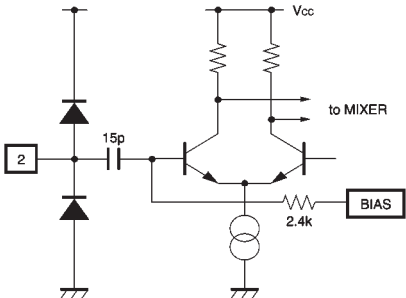
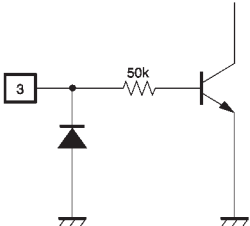
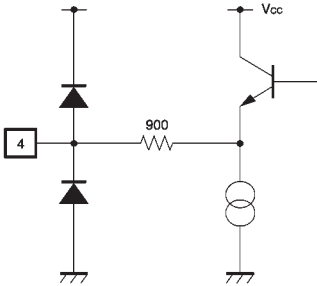
### ●Recommended operating conditions (Ta = 25 °C, for measurement circuit)

| Parameter             | Symbol           | Limits  | Unit |
|-----------------------|------------------|---------|------|
| Power supply voltage  | V <sub>cc</sub>  | 2.3~5.5 | V    |
| Operating temperature | T <sub>por</sub> | −40~+85 | °C   |

● Block diagram



● Pin descriptions

| Pin No. | Function                                                                                         | Internal peripheral circuit                                                         | DC voltage (V) |
|---------|--------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|----------------|
| 1       | GND pin 2                                                                                        | GND for MIX stage                                                                   | GND            |
| 2       | Local oscillation input pin<br>Input from external oscillator                                    |   | —              |
| 3       | Battery save pin<br>“Pin 3 voltage” ≤ 0.2V : Battery save<br>2V ≤ “Pin 3 voltage” ≤ Vcc : Active |   | —              |
| 4       | Mixer output pin<br>Connect ceramic filter<br>Output impedance: 1 kΩ                             |  | Vcc − 1.6      |
| 5       | Vcc pin 1                                                                                        | Vcc for MIX stage and IF amplifier early stage                                      | Vcc            |

| Pin No. | Function                                                                   | Internal peripheral circuit | DC voltage (V) |
|---------|----------------------------------------------------------------------------|-----------------------------|----------------|
| 6       | IF amplifier bypass pin<br>Connect capacitor                               |                             | $V_{CC}-0.6$   |
| 7       | IF amplifier input pin<br>Connect ceramic filter<br>Output impedance: 1 kΩ |                             | $V_{CC}-0.6$   |
| 8       | $V_{CC}$ pin 2                                                             | $V_{CC}$ for IF later stage | $V_{CC}$       |
| 9, 10   | IF amplifier output pin<br>Pins 9 and 10 are opposite-phase output         |                             | $V_{CC}-1.2$   |
| 11      | RSSI output pin<br>Connect capacitor                                       |                             | 0.15           |

| Pin No. | Function                                                  | Internal peripheral circuit       | DC voltage (V) |
|---------|-----------------------------------------------------------|-----------------------------------|----------------|
| 12      | Buffer amplifier non-inverting input pin                  |                                   | —              |
| 13      | Buffer amplifier inverting input pin                      |                                   |                |
| 14      | Buffer amplifier output pin                               |                                   | —              |
| 15      | GND pin 1                                                 | GND for IF stage and RSSI circuit | GND            |
| 16      | Mixer input pin<br>Connect first IF signal from DC cutoff |                                   | 1.2            |

- Electrical characteristics (unless otherwise noted,  $T_a = 25^\circ\text{C}$ ,  $V_{CC} = 3.0\text{V}$   
Signal source :  $f_{IN(MIX)} = 130\text{MHz}$ ,  $f_{IN(LO)} = 129.55\text{MHz}$ ,  $100\text{dB } \mu\text{V}$   
AC level to be indicated by termination)

| Parameter                           | Symbol        | Min. | Typ.           | Max.     | Unit             | Conditions                                                         |
|-------------------------------------|---------------|------|----------------|----------|------------------|--------------------------------------------------------------------|
| Quiescent current                   | $I_Q$         | —    | 3.0            | 3.9      | mA               | $V_{IN(LO)} = 100\text{dB } \mu\text{V}$                           |
| Battery save quiescent current      | $I_Q(BS)$     | —    | 0              | 5        | $\mu\text{A}$    |                                                                    |
| Battery save function input voltage | $V_{TH-H}$    | 2    | —              | $V_{CC}$ | V                | Active                                                             |
|                                     | $V_{TH-L}$    | GND  | —              | 0.2      | V                | Battery save                                                       |
| 〈MIX - oscillator section〉          |               |      |                |          |                  |                                                                    |
| Mixer operating frequency           | $f_{MIX}$     | 10   | 130            | 200      | MHz              |                                                                    |
| Mixer conversion gain               | $G_{VC}$      | 8.5  | 12.5           | 16.5     | dB               | $V_{IN(MIX)} = 60\text{dB } \mu\text{V}$ , $R_L = 1\text{k}\Omega$ |
| −1 dB compression output level      | $V_{OM}$      | —    | 101            | —        | dB $\mu\text{V}$ |                                                                    |
| 3rd order intercept point           | $IP_3$        | —    | 115            | —        | dB $\mu\text{V}$ | $f_1 = 130.05\text{MHz}$ , $f_2 = 130.10\text{MHz}$                |
| Noise figure                        | NF            | —    | 8.5            | —        | dB               | LC matching input                                                  |
| Mixer input admittance              | $Y_{IN(MIX)}$ | —    | $0.38 + j2.75$ | —        | ms               | $f = 130\text{MHz}$                                                |
| Mixer output resistance             | $R_{O(MIX)}$  | —    | 1              | —        | k $\Omega$       |                                                                    |
| Local input level                   | $V_{IN(LO)}$  | 95   | 100            | 105      | dB $\mu\text{V}$ |                                                                    |
| Local input admittance              | $Y_{IN(LO)}$  | —    | $0.25 + j3.65$ | —        | ms               | $f = 130\text{MHz}$                                                |
| 〈IF section〉                        |               |      |                |          |                  |                                                                    |
| IF operating frequency              | $f_{IF}$      | 350  | —              | 500      | kHz              |                                                                    |
| IF amplifier gain                   | $G_V$         | —    | 100            | —        | dB               |                                                                    |
| IF input resistance                 | $R_{IN(IF)}$  | —    | 1              | —        | k $\Omega$       |                                                                    |
| IF output level                     | $V_{OIF}$     | 0.7  | 1              | 1.3      | V <sub>P-P</sub> | $V_{IN(IF)} = 80\text{dB } \mu\text{V}$                            |
| IF output duty ratio                | $D_R$         | 45   | 50             | 55       | %                | $V_{IN(IF)} = 80\text{dB } \mu\text{V}$ , $C_L = 10\text{pF}$      |
| 〈RSSI section〉                      |               |      |                |          |                  |                                                                    |
| Output voltage 1                    | $V_{RSSI1}$   | —    | 0.15           | 0.4      | V                | No input                                                           |
| Output voltage 2                    | $V_{RSSI2}$   | 1.0  | 1.2            | 1.4      | V                | $V_{IN(IF)} = 65\text{dB } \mu\text{V}$                            |
| Output voltage 3                    | $V_{RSSI3}$   | 1.9  | 2.0            | 2.2      | V                | $V_{IN(IF)} = 100\text{dB } \mu\text{V}$                           |
| Dynamic range                       | $D_R$         | —    | 85             | —        | dB               |                                                                    |
| Output resistance                   | $R_{O(RSSI)}$ | 40   | 50             | 60       | k $\Omega$       |                                                                    |
| Rise time at power on               | $T_{ON}$      | —    | 140            | —        | $\mu\text{s}$    | $C_L = 1000\text{pF}$ , $V_{IN(MIX)} = 60\text{dB } \mu\text{V}$   |
| Fall time at power off              | $T_{OFF}$     | —    | 130            | —        | $\mu\text{s}$    | $C_L = 1000\text{pF}$ , $V_{IN(MIX)} = 60\text{dB } \mu\text{V}$   |
| RSSI rise time                      | $T_R$         | —    | 270            | —        | $\mu\text{s}$    | $C_L = 1000\text{pF}$ , $V_{IN(MIX)} = 60\text{dB } \mu\text{V}$   |
| RSSI fall time                      | $T_F$         | —    | 220            | —        | $\mu\text{s}$    | $C_L = 1000\text{pF}$ , $V_{IN(MIX)} = 60\text{dB } \mu\text{V}$   |

©Not designed for radiation resistance.

$C_L=10\text{pF}$   
(Includes the capacity of the measurement system.)

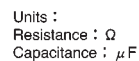


Fig. 1

## ●Application example

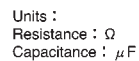
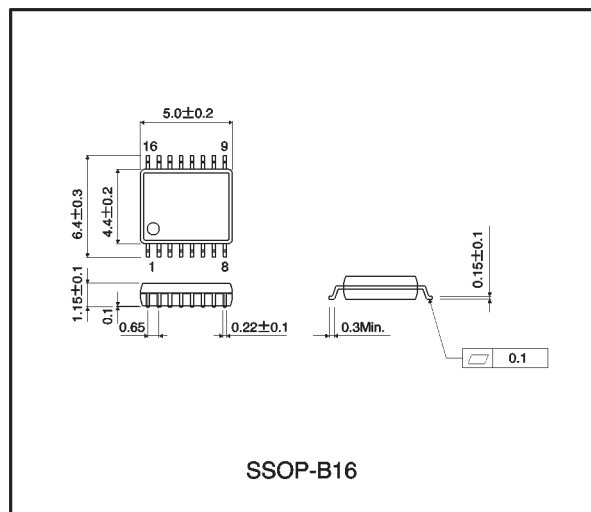


Fig. 2

● External dimensions (Units: mm)





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