

2nd mixer and IF amplifier IC for digital cellular

BH4138FV

The BH4138FV is an IC developed for use with digital cellular phones. This IC contains a 2nd mixer and IF amplifier.

●Applications

Digital cellular phones

●Features

- 1) Mixer circuit, IF amplifier, and RSSI circuit are built-in.
- 2) Mixer input frequency response 10MHz to 200MHz.
- 3) The recommended IF amplifier frequencies are 450kHz and 455kHz.
- 4) High gain IF amplifier (100dB).
- 5) Battery saving function.
- 6) Buffer amplifier for RSSI.
- 7) Low voltage operation (2.3V to 5.5V).

●Absolute maximum ratings (Ta = 25°C)

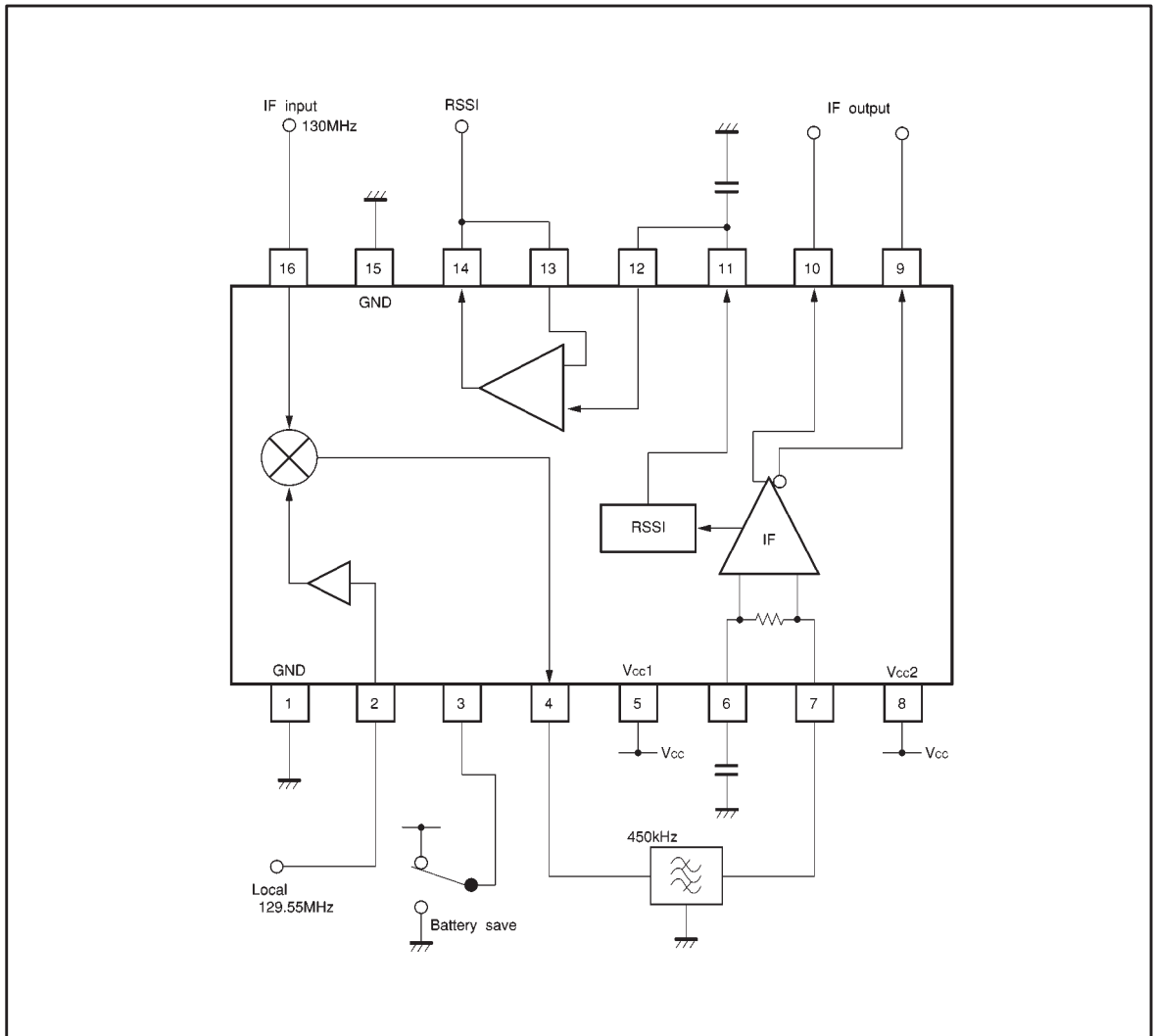
Parameter	Symbol	Limits	Unit
Power supply voltage	V _{CC}	7.0	V
Power dissipation	P _d	350*1	mW
Storage temperature	T _{sig}	−55~+125	°C

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

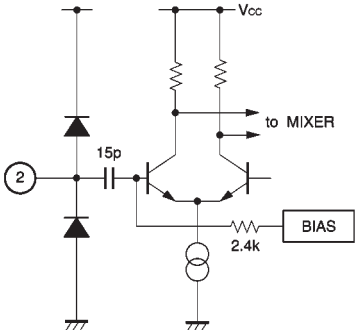
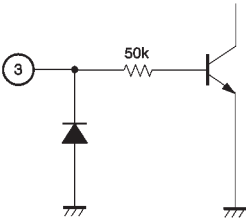
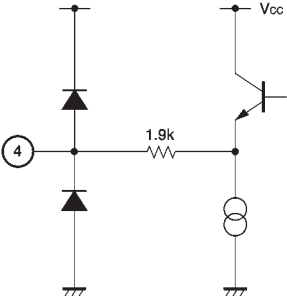
●Recommended operating conditions (Ta = 25°C)

Parameter	Symbol	Limits	Unit	Conditions
Operating power supply voltage	V _{CC}	2.3~5.5	V	—
Operating temperature	T _{opr}	−40~+85	°C	—
Mixer input frequency	f _{MIX IN}	10~200	MHz	pin 16
Mixer output frequency	f _{MIX OUT}	350~500	kHz	pin 4
IF input frequency	f _{IF IN}	350~500	kHz	pin 7
Mixer input level	V _{MIX IN}	10~95	dB μ V	pin 16
Local input level	V _{LO IN}	95~105	dB μ V	pin 2
IF input level	V _{IF IN}	15~100	dB μ V	pin 7
Battery saving input voltage	V _{TH-H}	2~V _{CC}	V	Active
	V _{TH-L}	−0.3~+0.2	V	Battery saving

● Block diagram



●Pin descriptions

Pin No.	Function	Equivalent circuit	DC voltage (V)
1	GND	GND	GND
2	Local oscillation input pin Input from the external oscillator.		—
3	Battery saving pin $V_{p3} \leq 0.2V$: battery saving $2V \leq V_{p3} \leq V_{cc}$: active (V_{p3} : voltage at pin 3)		—
4	Mixer output pin Connect to ceramic filter. Output impedance is 2kΩ		$V_{cc}-1.6$
5	Power supply pin	The power supply for mixer stage and front of the IF amplifier.	V_{cc}

Pin No.	Function	Equivalent circuit	DC voltage (V)
6	IF amplifier output pin Connect a capacitor.		$V_{CC}-0.6$
7	IF amplifier input pin Connect a ceramic filter. Input impedance is $2k\Omega$		$V_{CC}-0.6$
8	Power supply pin 2	The power supply for the IF rear stage.	V_{CC}
9,10	IF amplifier output pin Pins 9 and 10 output opposite phase.		$V_{CC}-1.2$
11	RSSI output pin Connect a capacitor.		0.15

Pin No.	Function	Equivalent circuit	DC voltage (V)
12	Non-inverting input pin of the buffer amplifier		—
13	Inverting input pin of the buffer amplifier		
14	Output pin of the buffer amplifier		—
15	GND	GND	GND
16	Mixer input pin Input 1st IF signal by DC cut.		1.2

- Electrical characteristics (unless otherwise noted, $T_a = 25^\circ\text{C}$, $V_{CC} = 3.0\text{V}$, SG1 $f_{IN(MIX)} = 130\text{MHz}$, SG2 $f_{IN(LO)} = 129.55\text{MHz}$, $100\text{dB}\mu\text{V}$, SG3 $f_{IN(IF)} = 450\text{kHz}$)

Alternating level to be indicated by termination.

*Items marked with an asterisk are reference values

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Quiescent current	I _o	—	3.0	3.9	mA	V _{IN(LO)} =100dB μ V SW1=1
Quiescent current during battery saving	I _{o(BS)}	—	0	5	μ A	V _{IN(LO)} =100dB μ V SW1=2
〈MIX—local oscillator stage〉						
Mixer conversion gain	G _{vc}	8.5	12.5	16.5	dB	V _{IN(MIX)} =60dB μ V SW2=1 (R _L =2k Ω)
1dB gain compression level*	V _{OM}	96	101	—	dB μ V	—
3rd order intercept point*	IP ₃	110	115	—	dB μ V	f ₁ =130.05MHz, f ₂ =130.10MHz
Noise figure*	NF	—	8.5	12.5	dB	Matched impedance input
Mixer input admittance*	Y _{IN(MIX)}	0.38+j2.75			ms	f=130MHz G+jB
Mixer output resistance*	R _{O(MIX)}	1.6	2	2.4	kΩ	—
Local oscillator input admittance*	Y _{IN(LO)}	0.25+j3.65			ms	f=130MHz G+jB
〈IF stage〉						
IF gain*	G _v	95	100	105	dB	—
Input resistance*	R _{IN(IF)}	1.6	2	2.4	kΩ	—
Output level	V _{OIF}	0.7	1	1.3	V _{P-P}	V _{IN(IF)} =80dB μ V SW2=2
Output duty ratio	DR	45	50	55	%	V _{IN(IF)} =80dB μ V, C _L =10pF SW2=2
Phase delay*	Δ Φ	—	3	15	deg	V _{IN(IF)} =30dB μ V~105dB μ V

- Electrical characteristics (unless otherwise noted, Ta = 25°C, V_{CC} = 3.0V, SG1 f_{IN(MIX)} = 130MHz, SG2 f_{IN(LO)} = 129.55MHz, 100dBμV, SG3 f_{IN(IF)} = 450kHz)

Alternating level to be indicated by termination.

*Items marked with an asterisk are reference values

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
〈RSSI stage〉						
Output voltage 1	V _{RSSI1}	—	0.15	0.4	V	No input SW2=2
Output voltage 2	V _{RSSI2}	1.0	1.2	1.4	V	V _{IN(IF)} =65dB μV SW2=2
Output voltage 3	V _{RSSI3}	1.9	2.0	2.2	V	V _{IN(IF)} =100dB μV SW2=2
Output voltage 4	V _{RSSI4}	0.5	0.7	0.9	V	V _{IN(IF)} =40dB μV SW2=2
Output voltage 5	V _{RSSI5}	1.4	1.6	1.8	V	V _{IN(IF)} =80dB μV SW2=2
Dynamic range*	D _R	80	85	—	dB	—
Linearity*	L _R	—	—	±2.5	dB	It computes in the regression from V _{IN(MIX)} =10dB μV to 90dB μV
Slope*	S _R	1.91	21.3	23.4	mV/dB	It computes in the regression from V _{IN(MIX)} =10dB μV to 90dB μV
Output resistance*	R _{O(RSSI)}	40	50	60	kΩ	—
Power supply ON rise time*	T _{ON}	—	270	405	μs	C _L =100pF SW ₁ =2→1 V _{IN(MIX)} =35~100dB μV
Power supply OFF fall time*	T _{OFF}	—	130	195	μs	C _L =1000pF SW ₁ =1→2 V _{IN(MIX)} =35~100dB μV
RSSI rise time*	T _R	—	150	225	μs	C _L =1000pF SG1=OFF→V _{IN(MIX)} V _{IN(MIX)} =35~100dB μV
RSSI fall time*	T _F	—	410	615	μs	C _L =1000pF SG1=V _{IN(MIX)} →OFF V _{IN(MIX)} =35~100dB μV

◎Not designed for radiation resistance.

● Measurement circuit

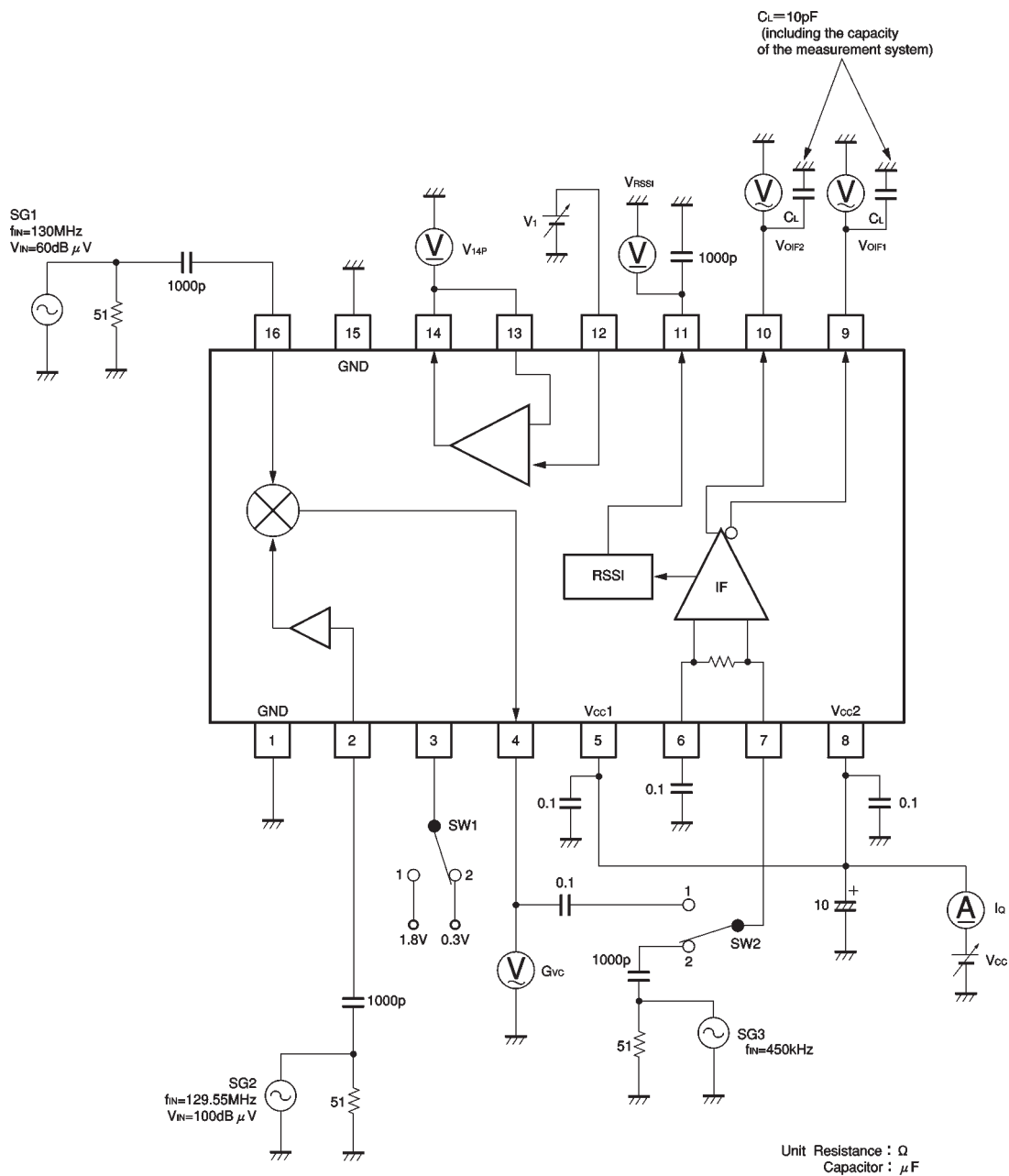


Fig.1

●Application example

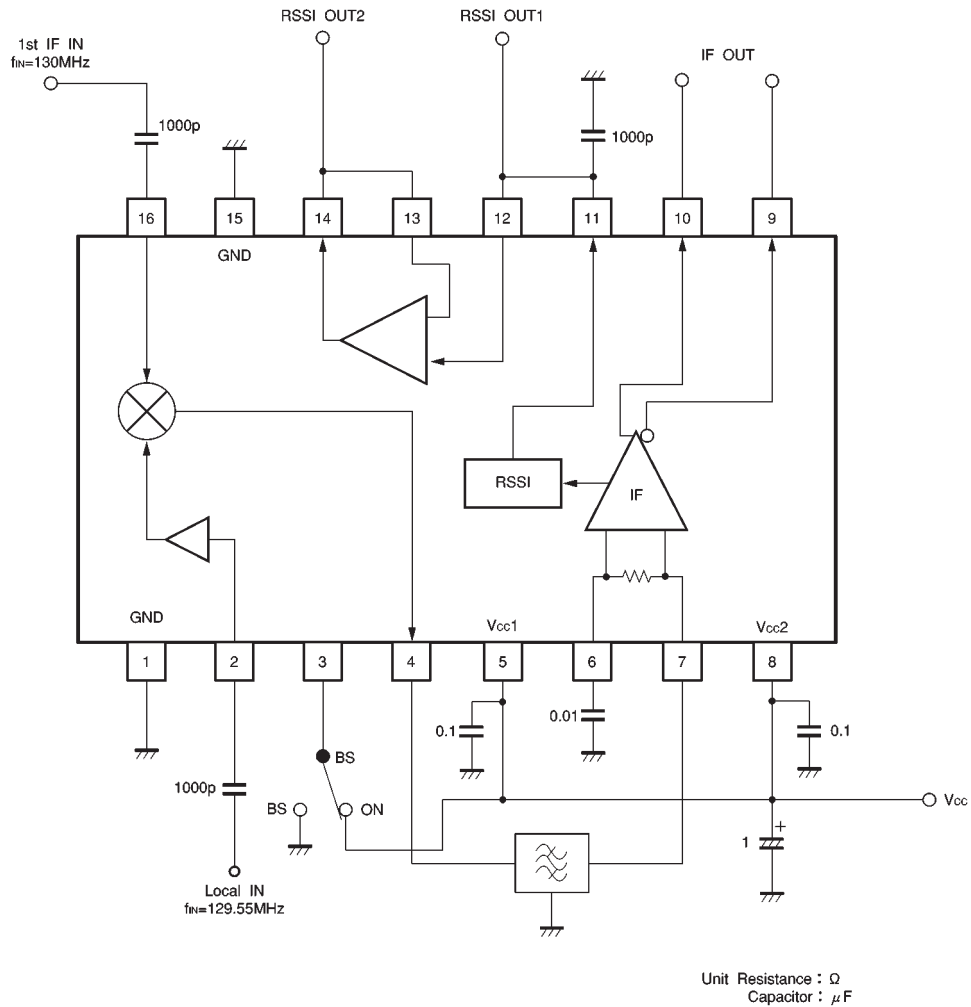
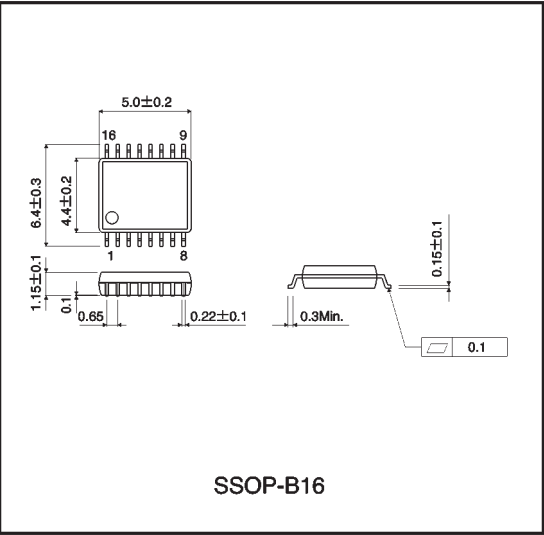


Fig.2

●External dimensions (Units: mm)



Notes

- No technical content pages of this document may be reproduced in any form or transmitted by any means without prior permission of ROHM CO.,LTD.
- The contents described herein are subject to change without notice. The specifications for the product described in this document are for reference only. Upon actual use, therefore, please request that specifications to be separately delivered.
- Application circuit diagrams and circuit constants contained herein are shown as examples of standard use and operation. Please pay careful attention to the peripheral conditions when designing circuits and deciding upon circuit constants in the set.
- Any data, including, but not limited to application circuit diagrams information, described herein are intended only as illustrations of such devices and not as the specifications for such devices. ROHM CO.,LTD. disclaims any warranty that any use of such devices shall be free from infringement of any third party's intellectual property rights or other proprietary rights, and further, assumes no liability of whatsoever nature in the event of any such infringement, or arising from or connected with or related to the use of such devices.
- Upon the sale of any such devices, other than for buyer's right to use such devices itself, resell or otherwise dispose of the same, no express or implied right or license to practice or commercially exploit any intellectual property rights or other proprietary rights owned or controlled by
- ROHM CO., LTD. is granted to any such buyer.
- Products listed in this document use silicon as a basic material.
Products listed in this document are no antiradiation design.

The products listed in this document are designed to be used with ordinary electronic equipment or devices (such as audio visual equipment, office-automation equipment, communications devices, electrical appliances and electronic toys).

Should you intend to use these products with equipment or devices which require an extremely high level of reliability and the malfunction of which would directly endanger human life (such as medical instruments, transportation equipment, aerospace machinery, nuclear-reactor controllers, fuel controllers and other safety devices), please be sure to consult with our sales representative in advance.

About Export Control Order in Japan

Products described herein are the objects of controlled goods in Annex 1 (Item 16) of Export Trade Control Order in Japan.

In case of export from Japan, please confirm if it applies to "objective" criteria or an "informed" (by MITI clause) on the basis of "catch all controls for Non-Proliferation of Weapons of Mass Destruction.