

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)

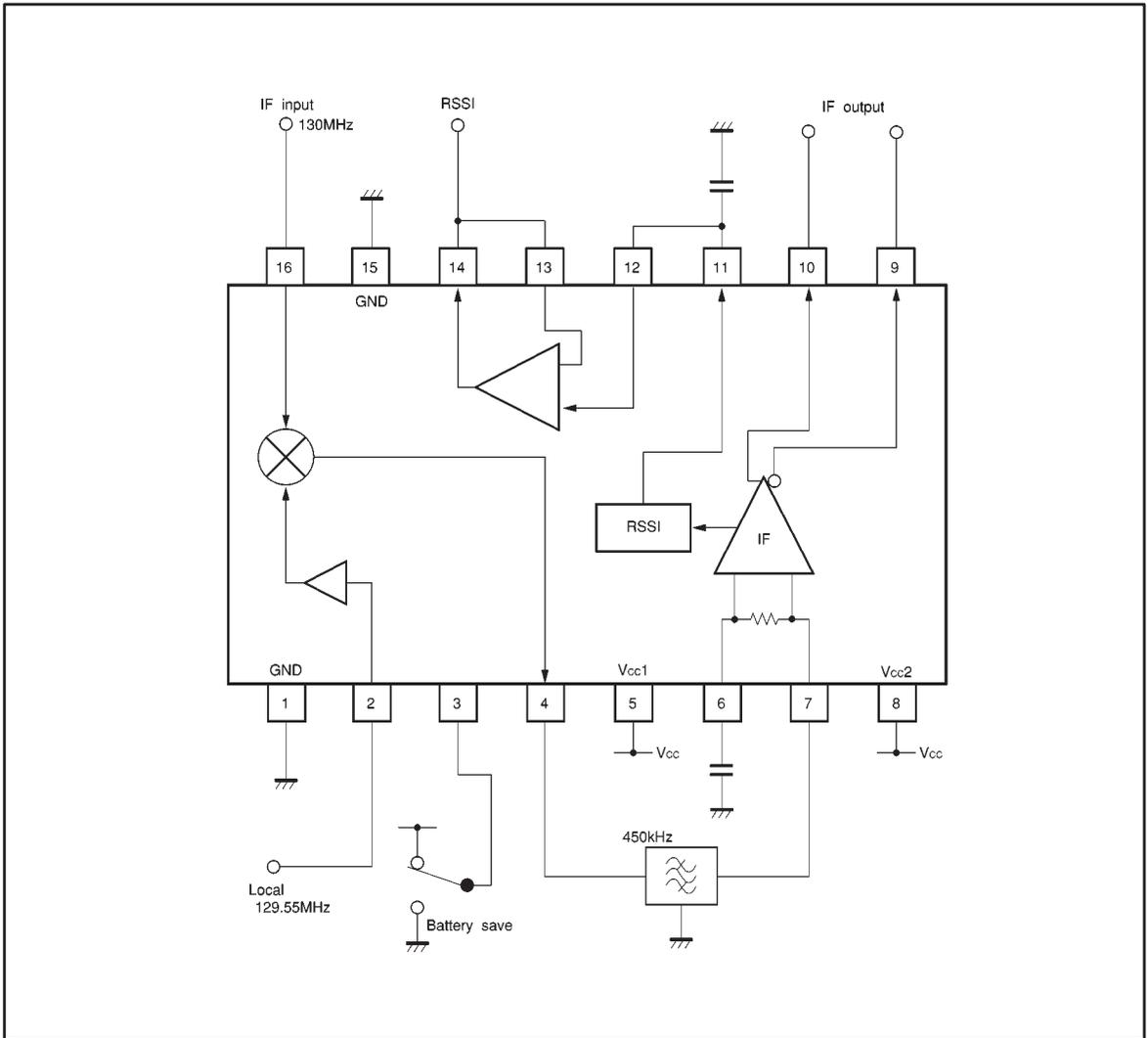
Parameter	Symbol	Limits	Unit
Power supply voltage	V _{CC}	7.0	V
Power dissipation	P _d	350*1	mW
Storage temperature	T _{sig}	-55~+125	°C

*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 μV	pin 16
Local input level	V _{LO IN}	95~105	dB μV	pin 2
IF input level	V _{IF IN}	15~100	dB μV	pin 7
Battery saving input voltage	V _{TH-H}	2~V _{CC}	V	Active
	V _{TH-L}	-0.3~+0.2	V	Battery saving

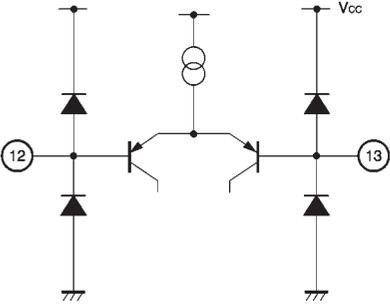
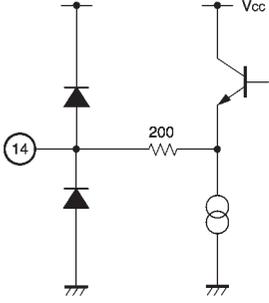
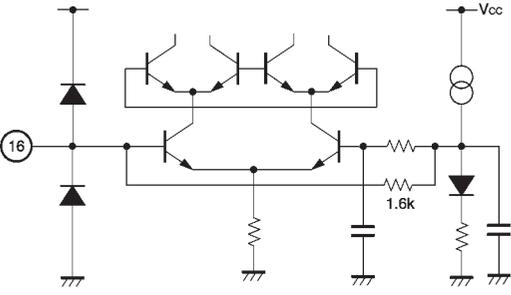
● Block diagram



● 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 $2k\Omega$		$V_{cc}-1.6$
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	$V_{IN(LO)}=100\text{dB}\mu\text{V}$ $SW1=1$
Quiescent current during battery saving	$I_{o(BS)}$	—	0	5	μA	$V_{IN(LO)}=100\text{dB}\mu\text{V}$ $SW1=2$
〈MIX—local oscillator stage〉						
Mixer conversion gain	G_{vc}	8.5	12.5	16.5	dB	$V_{IN(MIX)}=60\text{dB}\mu\text{V}$ $SW2=1$ ($R_L=2\text{k}\Omega$)
1dB gain compression level*	V_{OM}	96	101	—	dB μV	—
3rd order intercept point*	IP_3	110	115	—	dB μV	$f_1=130.05\text{MHz}$, $f_2=130.10\text{MHz}$
Noise figure*	NF	—	8.5	12.5	dB	Matched impedance input
Mixer input admittance*	$Y_{IN(MIX)}$	0.38+j2.75			ms	$f=130\text{MHz}$ $G+jB$
Mixer output resistance*	$R_{O(MIX)}$	1.6	2	2.4	k Ω	—
Local oscillator input admittance*	$Y_{IN(LO)}$	0.25+j3.65			ms	$f=130\text{MHz}$ $G+jB$
〈IF stage〉						
IF gain*	G_v	95	100	105	dB	—
Input resistance*	$R_{IN(IF)}$	1.6	2	2.4	k Ω	—
Output level	V_{OIF}	0.7	1	1.3	V_{P-P}	$V_{IN(IF)}=80\text{dB}\mu\text{V}$ $SW2=2$
Output duty ratio	DR	45	50	55	%	$V_{IN(IF)}=80\text{dB}\mu\text{V}$, $C_L=10\text{pF}$ $SW2=2$
Phase delay*	$\Delta\Phi$	—	3	15	deg	$V_{IN(IF)}=30\text{dB}\mu\text{V}\sim 105\text{dB}\mu\text{V}$

- 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

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●Application example

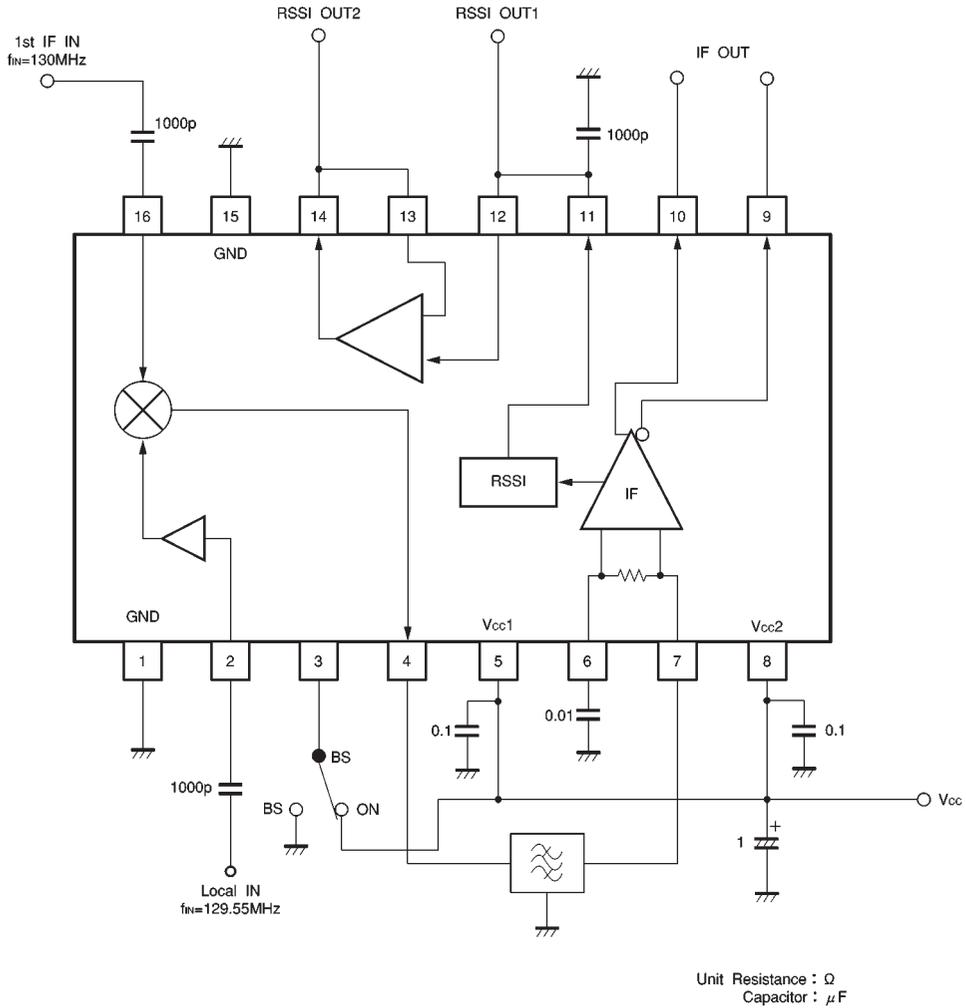
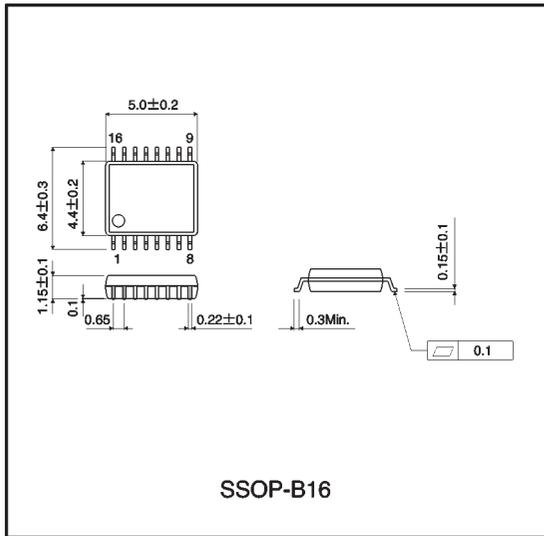


Fig.2

● External dimensions (Units: mm)



ROHM-logo

Product Designation

- **When ordering, specify the part number.**
- **Check each code against the tables shown below.**
- **Fill in from the left, leaving any extra boxes empty on the right.**

Product Designation

Ordering information

Packing and forming information only required for SOP, and QFP parts that are required in tape and reel containers. For example, to order part BA4558F on paper tape type E2, order number is BA4558F-E2, when required in tube container, order number is BA4558F.

<input checked="" type="checkbox"/> Quick reference of packaging specifications		
Package	Container type	Packaging specification code
DIP/SDIP	Tube container	
SIP/HSIP/ZIP/SZIP/RSIP-A3	Tube container	
SOP/SSOP/HSOP/WSOP-10/WSOP-L10	Tube container	
	Embossed tape	E1, E2

SSOP-A54	Embossed tape	E2
QFP/SQFP/VQFP/UQFP/TQFP/PBGA	Tray	
	Tray (dry pack)	VP
	Embossed tape	E1, E2
TO220FP	Bulk	
	Tube container	
SMP5	Embossed tape	TL, TR
TO252	Embossed tape	E1, E2
RSLP8	Embossed tape	E2(Sprocket 1pin, Horizontal)
RSIP13	Embossed tape	E2(Sprocket 1pin, Horizontal), E4 (Sprocket 1pin, Vertical)

Note: SOP type can be delivered in tube, paper tape, or embossed tape.

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[QFP package](#) | [Photo package](#)

[SOP package](#) | **Product Designation**

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