

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)

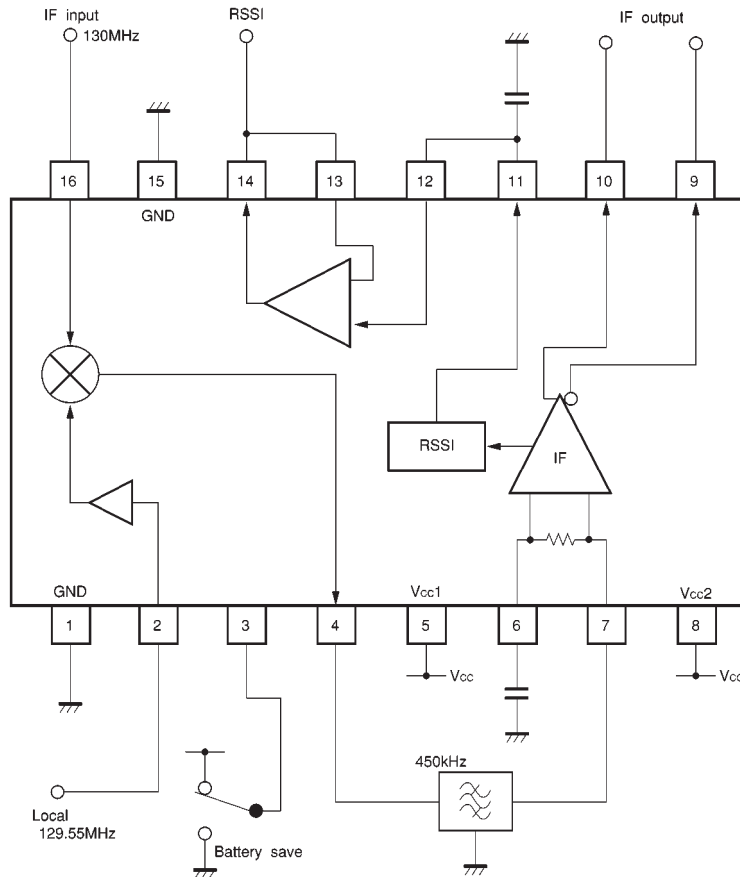
Parameter	Symbol	Limits	Unit
Power supply voltage	V _{CC}	7.0	V
Power dissipation	P _d	350*1	mW
Storage temperature	T _{sig}	-55~+125	°C

*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}

	$V_{CC}-0.6$ $V_{CC}-0.6$
The power supply for the IF rear stage.	V_{CC} $V_{CC}-1.2$
	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 $f_{\text{IN(MIX)}} = 130\text{MHz}$, SG2 $f_{\text{IN(LO)}} = 129.55\text{MHz}$, $100\text{dB}\mu\text{V}$, SG3 $f_{\text{IN(IF)}} = 450\text{kHz}$)

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

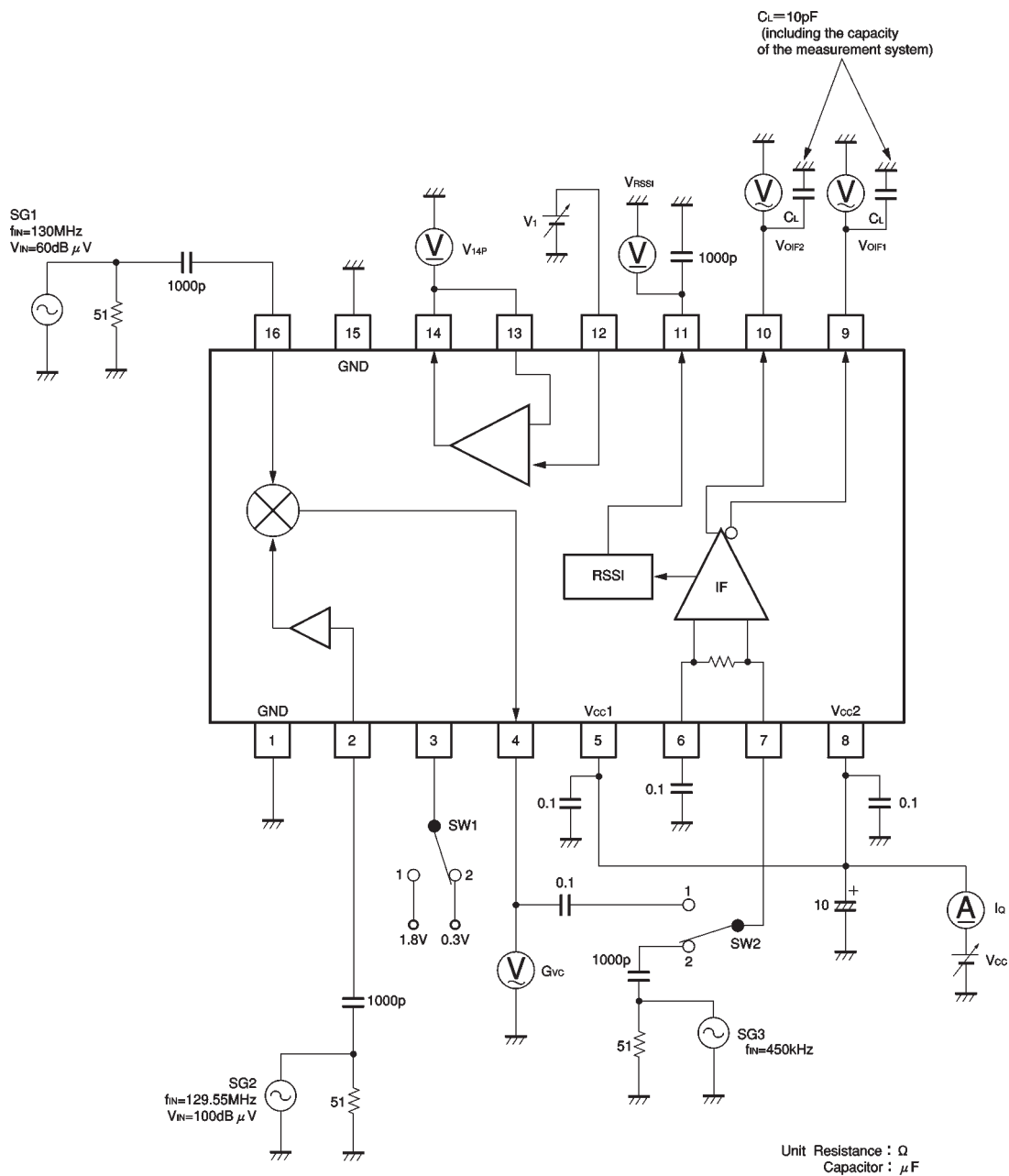
Alternating level to be indicated by termination.

*Items marked with an asterisk are reference values

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
〈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	$V_{\text{IN(IF)}}=65\text{dB}\mu\text{V}$ SW2=2
Output voltage 3	V_{RSSI3}	1.9	2.0	2.2	V	$V_{\text{IN(IF)}}=100\text{dB}\mu\text{V}$ SW2=2
Output voltage 4	V_{RSSI4}	0.5	0.7	0.9	V	$V_{\text{IN(IF)}}=40\text{dB}\mu\text{V}$ SW2=2
Output voltage 5	V_{RSSI5}	1.4	1.6	1.8	V	$V_{\text{IN(IF)}}=80\text{dB}\mu\text{V}$ SW2=2
Dynamic range*	D_R	80	85	—	dB	—
Linearity*	L_R	—	—	± 2.5	dB	It computes in the regression from $V_{\text{IN(MIX)}}=10\text{dB}\mu\text{V}$ to $90\text{dB}\mu\text{V}$
Slope*	S_R	1.91	21.3	23.4	mV/dB	It computes in the regression from $V_{\text{IN(MIX)}}=10\text{dB}\mu\text{V}$ to $90\text{dB}\mu\text{V}$
Output resistance*	$R_{\text{O(RSSI)}}$	40	50	60	k Ω	—
Power supply ON rise time*	T_{ON}	—	270	405	μs	$C_L=100\text{pF}$ SW1=2→1 $V_{\text{IN(MIX)}}=35\sim 100\text{dB}\mu\text{V}$
Power supply OFF fall time*	T_{OFF}	—	130	195	μs	$C_L=1000\text{pF}$ SW1=1→2 $V_{\text{IN(MIX)}}=35\sim 100\text{dB}\mu\text{V}$
RSSI rise time*	T_R	—	150	225	μs	$C_L=1000\text{pF}$ SG1=OFF→ $V_{\text{IN(MIX)}}$ $V_{\text{IN(MIX)}}=35\sim 100\text{dB}\mu\text{V}$
RSSI fall time*	T_F	—	410	615	μs	$C_L=1000\text{pF}$ SG1= $V_{\text{IN(MIX)}}$ →OFF $V_{\text{IN(MIX)}}=35\sim 100\text{dB}\mu\text{V}$

◎Not designed for radiation resistance.

● Measurement circuit



●Application example

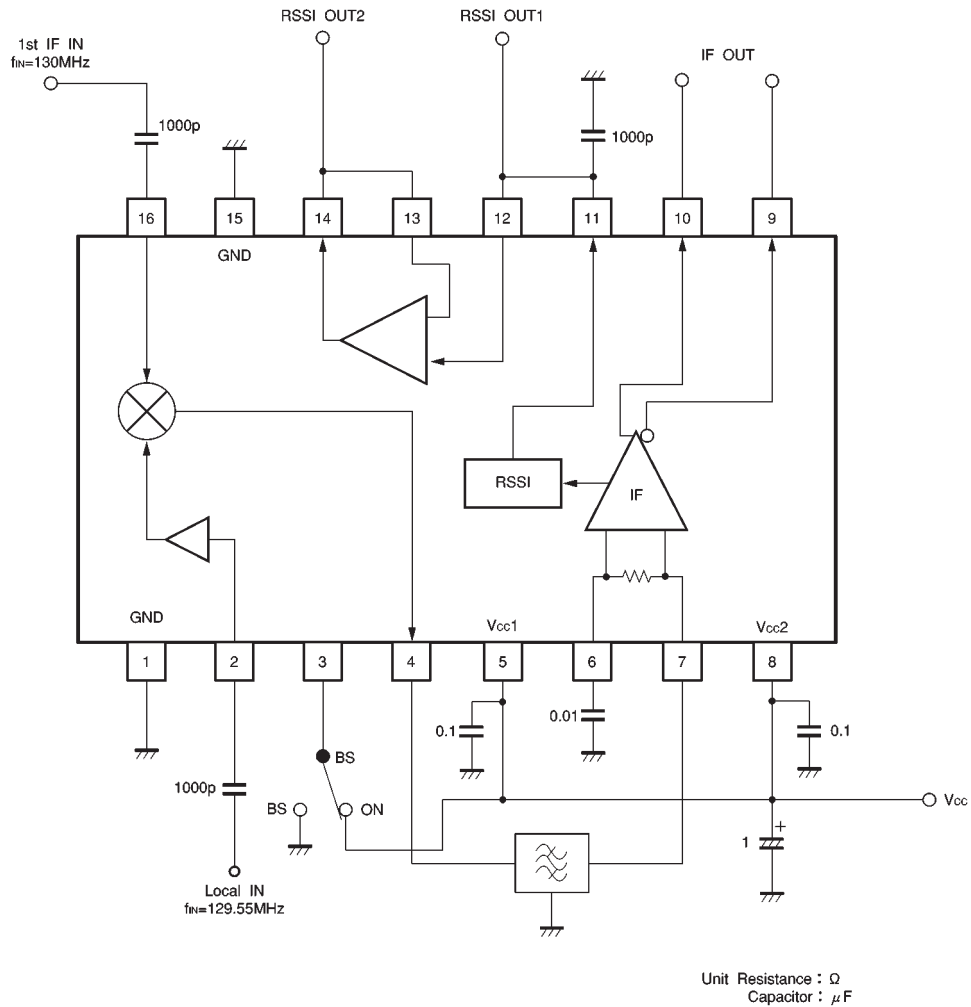


Fig.2

●External dimensions (Units: mm)

