FM
WIRELESS
AUDIO
LINK
Mini Broad Casting

Ver.1.1

Transmitter Function Description

Wireless Audio Link LSI

BH1415F/FV
BH1416F
BH1417F/FV
BH1418FV/KN

ROHM

№104

Introduction

The present document is so prepared to be a reference guide for those who design setting by use of our IC's. Important information items mainly about IC's and their external circuits are described herein. Be sure to read through the document and make the most of it before your setting development and during your designing work.

Note

The present document should be used as a reference guide for peripheral circuit designs in association with the delivery specifications. The described numeric values and data are design representative values, and the values are not guaranteed. We believe that the application circuit example is recommendable one, however, in practical use, further confirm characteristics sufficiently. In the case of use by changing external part constants, make your decision with sufficient margins in consideration of not only static characteristics but also transition characteristics and external parts and fluctuations of our IC's and so forth.

The terminal numbers described in the present document are for BH1415F, BH1416F, and BH1417F of SOP20 package version.
As for BH1415FV, BH1417FV, BH1418FV of SSOP-B24 package version, and BH1418KN of VQFN28 package, replace the terminal numbers for use.

- The described contents are subject to change without prior notice for improvement of the products. In practical use, confirm that the information is latest.
- Part or whole of the present document shall not be transferred or copied without permission.
- The described applied circuit example and information on its constants and the like is for explaining the standard actions and use of the products. Therefore, in your mass production design, we ask you to consider external various conditions.
- The applied circuit example, information and various data concerning the product described herein are only for showing an example, and do not show intellectual property rights such as industrial property right and the like of a third party about these, or other rights. Therefore, we shall not be responsible for (1) infringement upon intellectual property rights of the third party, or (2) any problem arising from these products, which please note.
- With regard to sales of these products, except use, sales, and other disposition of these products themselves, we shall not grant the buyer, expressly or implicatedly, licence or service of the intellectual property rights including industrial property rights and the likes or other rights that we own or control.
- The products are manufactured mainly of "silicon".
- The products are not of "anti radiation design".

Contents

1. Outline

BH1415F/FV, BH1416F, BH1417F/FV, and BH1418FV/KN are "wireless audio link IC's" that enable to dispatch music and audio such as PC, HDD recorder, CD and so forth via FM radio wave and enjoy them by audio devices having built-in FM receiver and so forth.

They comprise a pre emphasis circuit for improving S/N, a limiter circuit for preventing excessive nodulation, an LPF circuit for limiting the maximum modulation frequency, a stereo modulation circuit for making stereo composite signals, and an FM sending circuit by PLL frequency synthesizer for FM sending.

1.1 Features

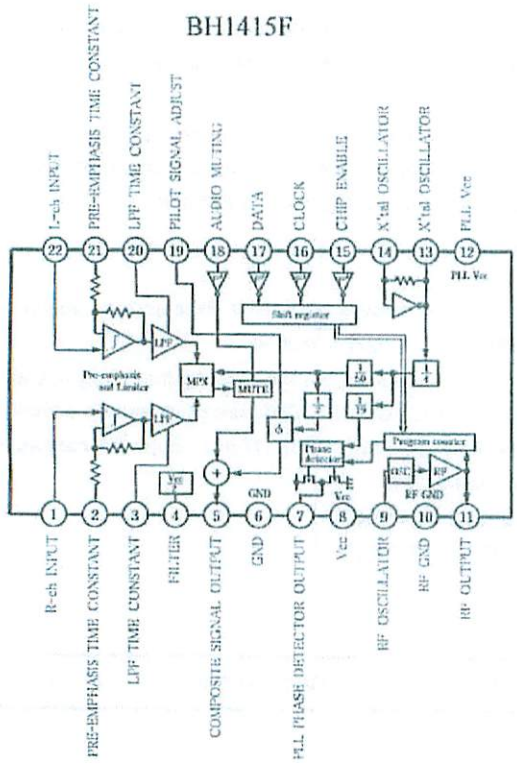
(1) Pre emphasis circuit, limiter circuit, and low pass filter circuits are built in for improving sound quality.
(2) GE · Zenith (pilot tone) method FM stereo modulation circuit is built in.
(3) FM transmitter circuit by PLL frequency synthesizer is built in, so the sending frequency is stable.
(4) BH1415F/FV and BH1418FV/KN adopt the serial BUS (CE, CK, DA) control method to control the sending frequency by a microcomputer, while BH1416F and BH1417F/FV adopt the hardware control method to control the sending frequency by a dip switch.
(5) Monaural actions are available (BH1415F/FV, BH1418FV/KN).
(6) Audio muting circuit is built in (BH1415F/FV, BH1418FV/KN).

1.2 List of series

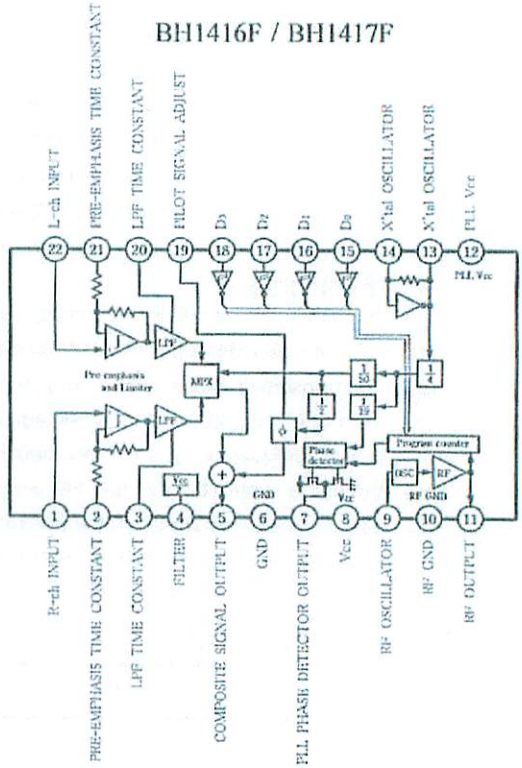
	BH1415F/FV	BH1416F	BH1417F/FV	BH1418FV/KN
Pre emphasis	○	○	○	○
Audio limiter level	Fixed	Fixed	Fixed	Fixed
Audio filter	15kHz 2nd order LPF	15kHz 2nd order LPF	15kHz 2nd order LPF	15kHz 2nd order LPF
Monaural actions	○	–	–	○
Audio mute	○	–	–	○
FM stereo modulator	○	○	○	○
FM transmitter	○	○	○	○
Sending frequency control method	3-wire serial I/F	Hardware control	Hardware control	3-wire serial I/F
RF amplifier	○	○	○	○
Sending frequency	70 ~ 120MHz step 100kHz	76.8 ~ 78.0MHz 88.0 ~ 89.2MHz step 200kHz	87.7 ~ 88.9MHz 106.7 ~ 107.9MHz step 200kHz	70 ~ 120MHz step 100kHz
Action power source voltage	4.0V ~ 6.0V	4.0V ~ 6.0V	4.0V ~ 6.0V	2.7 ~ 4.0V
Action temperature range	-40 ~ +85 °C	-40 ~ +85 °C	-40 ~ +85 °C	-20 ~ +85 °C
Package	SOP22/SSOP-B24	SOP22	SOP22/SSOP-B24	SSOP-B24/VQFN28

1.3 Block diagram

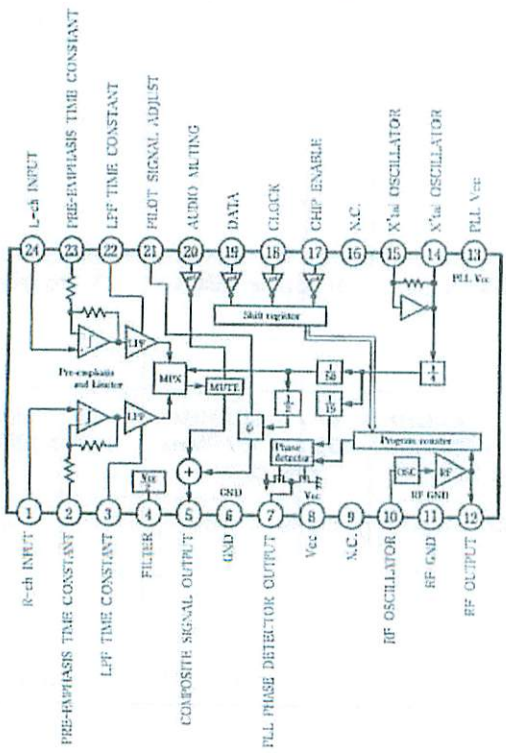
BH1415F



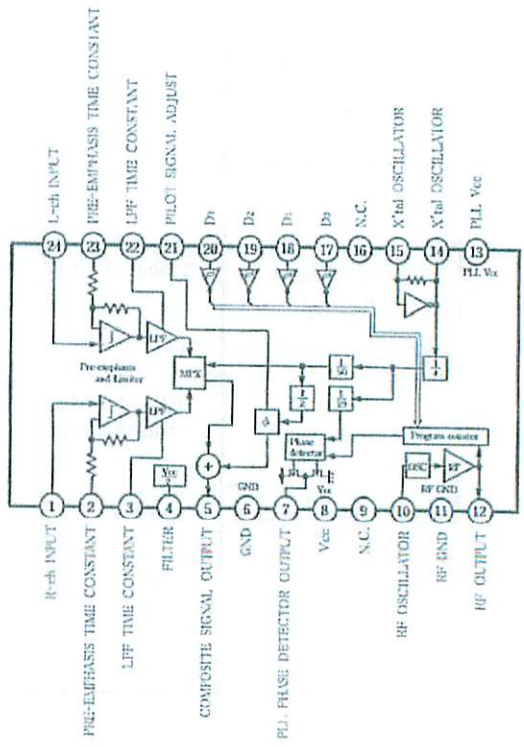
BH1416F / BH1417F



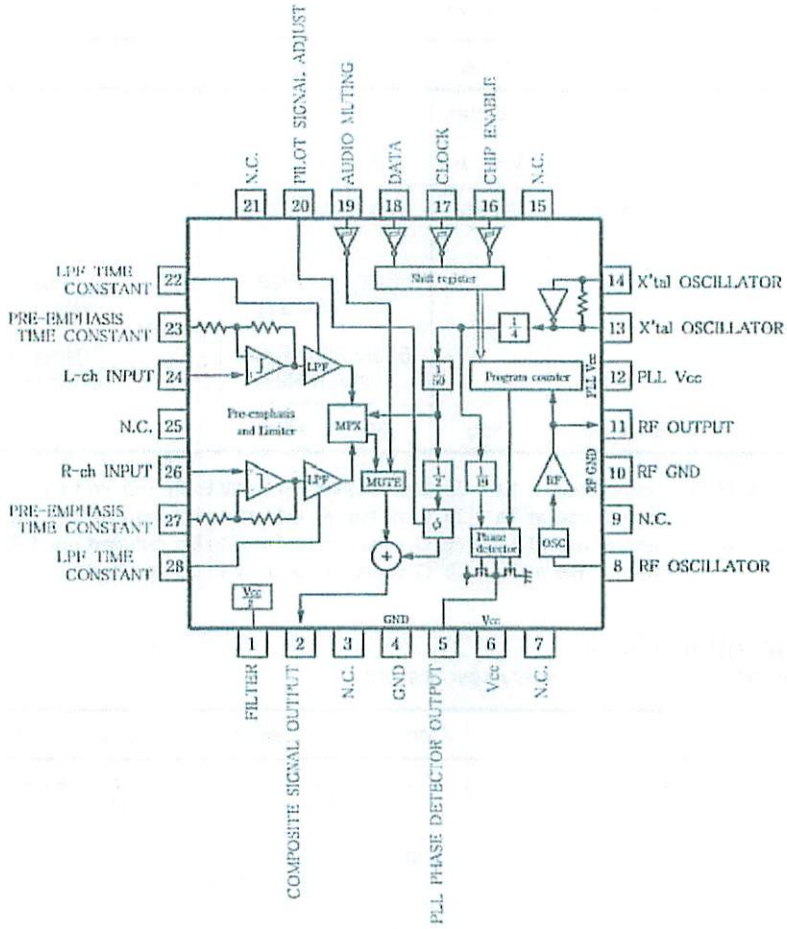
BH1415FV / BH1418FV



BH1417FV



BH1418KN


N.C.
PILOT SIGNAL ADJUST
AUDIO MUTING
DATA
CLOCK
CHIP ENABLE
N.C.
21
20
19
18
17
16
15
LPF TIME CONSTANT 22
PRE-EMPHASIS TIME CONSTANT 23
L-ch INPUT 24
N.C. 25
R-ch INPUT 26
PRE-EMPHASIS TIME CONSTANT 27
LPF TIME CONSTANT 28
14 X'tal OSCILLATOR
13 X'tal OSCILLATOR
12 PLL Vcc
11 RF OUTPUT
10 RF GND
9 N.C.
8 RF OSCILLATOR
Shift register
Program counter
Pre-emphasis and Limiter
MPX
MUTE
LPF
Phase detector
OSC
RF
PLL Vcc
RF GND
GND
Vcc
1
2
3
4
5
6
7
FILTER
COMPOSITE SIGNAL OUTPUT
N.C.
GND
PLL PHASE DETECTOR OUTPUT
Vcc
N.C.

1.4 Absolute maximum ratings

In order to prevent function deterioration and thermal destruction of semiconductor products, and guarantee their service life and reliability, carry out your design and evaluation so that the absolute maximum ratings should not be exceeded at any time and even for an instance.

Confirm the latest values in the delivery specifications.

Item	Code	Rating	Unit	Conditions
Power supply voltage	Vcc max	+7.0	V	Pin 8, 12
Data input voltage	V_{IN-D}	-0.3 ~ Vcc+0.3	V	Pin 15, 16, 17, 18
Phase comparator output voltage	V_{OUT-P}	-0.3 ~ Vcc+0.3	V	Pin 7
Power dissipation	Pd	1000 (SDIP22) 450 (SOP22) 630(SSOP-B24) 370(VQFN28)	mW	(Note 1) (Note 2) (Note 3) (Note 4)
Storage temperature range	Tstg	-55 ~ +125	°C	

(Note 1) In the case of use at Ta = 25 °C or higher, 10.0mW to be reduced per 1 °C.
(Note 2) In the case of use at Ta = 25 °C or higher, 4.5mW to be reduced per 1 °C.
(Note 3) In the case of use at Ta = 25 °C or higher, 6.3mW to be reduced per 1 °C.
(Note 4) In the case of use at Ta = 25 °C or higher, 3.7mW to be reduced per 1 °C.

1.5 Operating range

Confirm the latest values in the delivery specifications.

Item	Code	Rating	Unit	Conditions
Operating power supply voltage	Vcc	4.0 ~ 6.0 2.7 ~ 4.0 *1	V V	Pin8, 12
Operating temperature	Topr	-40 ~+85 -20 ~+85 *2	°C °C	
Audio input level	V_{IN-A}	~ -10	dBV	Pin1, 22
Audio input frequency	f_{IN-A}	20 ~ 15k	Hz	Pin1, 22
Pre emphasis time constant setting range	t_{PRE}	~ 155	μsec	Pin 2, 21
Control terminal "H" level input voltage	V_{IH}	0.8Vcc ~ Vcc	V	Pin 15, 16, 17, 18
Control terminal "L" level input voltage	V_{IL}	GND ~ 0.2Vcc	V	Pin 15, 16, 17, 18

*1, *2 : action range of BH1418FV/KN

1.6 General notes

● Necessity of maximum ratings

In order to prevent function deterioration and thermal destruction of semiconductor products, and guarantee their service life and reliability, it is necessary to see it that the absolute maximum ratings should not be exceeded at any time and even for an instance.

・Absolute maximum power source voltage VCCMAX

Use the product below this voltage. Continuous impression may be available at this voltage or below.

And in the case of a special mode where the absolute maximum rating may be exceeded, examine physical safety countermeasures such as fuse and the like.

・Storage temperature range Tstg

So long as IC's are stored in this range, their characteristics and functions will not be deteriorated. However, even in this range, abrupt temperature changes may lead to deterioration of IC characteristics and functions, therefore, pay special attention.

・IC junction temperature TjMAX

See to it that the junction temperature TjMAX = 150 °C should not be exceeded.

・Action temperature range Topr

In this range, various electric characteristics at Ta = 25 °C are not guaranteed, however, circuits work properly. If you have a question about the guarantee degree of circuit functions in the action temperature range, contact our technical members in advance.

● Notes to users

・Notes on storage and transportation

(1) When to store IC's, store them in a dry place at room temperature, for prevention of terminal oxidation and the like. At least observe the following conditions.

Humidity	75% or below
Temperature	0 ~ +30 °C

(2) Use an IC storage container free of static electricity.

(3) When to store IC's, keep them away from water or conductive liquid. Store them in a place free of harmful gas, dust or dirt.

(4) When to transport IC's, put them in a conductive case or an aluminum foil. Avoid a container that will be easily charged with electricity.

(5) When to transport IC's, insert insulation materials between PC substrates (mounted ones), and be sure to discharge capacitors and the likes.

(6) When to transport IC's, do not give IC's mechanical vibration or impact.

・Notes on attachment

(1) In some IC's, there are empty terminals on their circuit structures, but avoid using these as relay points on printed boards. When they are used as relay points, even empty terminals may cause oscillation or other troubles.

(2) If the heat dissipation plate is cut or deformed, or the package is deformed or processed, heat resistance will increase, and stress will work, leading to a failure.

(3) Since the heat dissipation plate is made at the same electric potential as GND of IC pellet, drop it to GND of circuit, or float it. In the case of use with the heat dissipation plate afloat, when voltage is impressed to the heat dissipation plate, IC will be destroyed.

(4) At attachment of the heat dissipation plate, when silicon grease is used, apply silicon grease evenly to reduce contact heat resistance. Some components of silicon grease absorb oil, and deteriorate reliability, therefore pay special attention in selecting silicon grease.

(5) When to attach the IC to a printed board, never make a mistake in IC direction.

As for SIP (single inline package) and ZIP (zigzag inline package), when the mark is placed toward you and characters are put in their right position, the left end shows 1 pin. As for DIP (dual inline package) and SOP (small outline package) and QFP (quad flat package), when the mark is upward and the characters are put in their right position, the left bottom shows 1 pin.

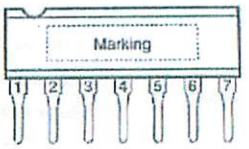
If the SOP SQFP IC is attached in wrong direction and electricity is supplied, IC may be destructed, therefore, pay sufficient attention.

(6) When to attach the IC to a printed board, make the interval of IC terminals same as the interval of attachment holes, and at inserting it, avoid excessive stress.

(7) Check whether the power source leaks to the soldering iron. If the soldering iron with electricity leakage is used, and its end contacts input pin or so of IC, the IC will be destructed.

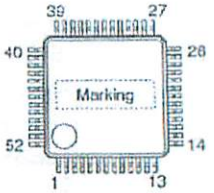
(8) Be sure to ground the human body, work desk, measurement device, belt conveyor to avoid AC leakage.

DIP



SIP

SOP



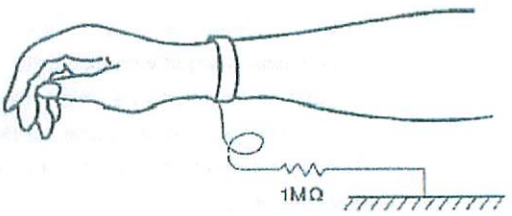
SQFP

In the case of human body, ground it with arm band as shown in the figure below. At that moment, insert resistance to human body side between human body and GND to prevent electric shock.

Be sure to ground the belt conveyor, and the connection portion of the work desk too. There are cases where many conveyor bases are connected and shortcircuit is not carried out between bases. Be sure to carry out grounding the entire to avoid leakage.

(9) In the case of static electricity, control well indoor humidity. Especially, static electricity will occur in winter, so sufficient attention is required.

(10) Pay attention to the wires from the input terminal and assembly order so that static electricity should not be impressed to IC. It is necessary to pay attention so that the terminals of printed board and the likes are circuited and made into same electric potential.



・Notes on measurement and inspection

(1) If voltage is impressed to board while IC is solder bridged, IC may be destructed, therefore, before impressing voltage, check soldering sufficiently.

(2) When the power switch of the power source and the measurement device is turned ON/OFF, unexpected large surge voltage may occur and destroy IC, therefore be sure to carry out grounding and make sure surge voltage will not occur.

(3) At measurement inspection, set the IC or board to the specified position, and supply power source. If the IC or the board is pulled or inserted while power source is supplied, terminal or measurement device needle contact order difference occurs and over current flows into IC to destroy it.

(4) Over current flows to IC and destroys it frequently, therefore, use power source with current limit circuit. If you have any question, consult our technical engineers. And in the case of use under special service conditions, consult them in prior.

・IC heat design

IC characteristics depend on temperatures used, and when the maximum allowable connection portion temperature is exceeded, element may be deteriorated or destructed. From 2 viewpoints of instantaneous destruction and reliability of long hour actions, it is necessary to pay sufficient attention to heat of IC. Pay attention to the following.

The absolute maximum rating of each IC shows the maximum connection portion temperature (TjMax.) or action temperature range (Topr), therefore, by reference to this value, obtain by use of Pd-Ta characteristics (heat reduction ratio curve).

IC has been designed with sufficient consideration on heat balance, so there is no problem on circuit actions, however, in order to make the most of the IC original functions, even if too sufficient heat dissipation design is made, in actual action use, it appears adequate in most cases.

Even with a large heat dissipater, if it is not fastened completely, sufficient heat dissipation cannot be expected. And, if ventilation around it is not good, IC temperature goes on up, therefore, carry out heat design in consideration of this too.

2. Description of actions

Note : The terminal numbers described in the present document are for BH1415F, BH1416F, and BH1417F of SOP20 package version.

As for BH1415FV, BH1417FV, BH1418FV of SSOP-B24 package version, and BH1418KN of VQFN28 package, replace the terminal numbers for use.

2.1 Pre emphasis circuit

Pre emphasis circuit is an audio amplifier comprising a non reverse amplifier. Internal action point is set to 1/2Vcc. Input impedance of 1 pin and 22 pin is non reverse amplifier so determined by 43kΩ of R_3.

Time constant of pre emphasis is determined by resistance R_2 of IC inside and external capacitor C_1.

Time constant $\tau = C_1 R_2$

Utilizing the transfer function $|T| = \sqrt{1+\left(\frac{\omega}{\omega_0}\right)^2}$

the inout /output gain is calculated from $G_V = 20 \log_{10} \sqrt{1+\left(\frac{\omega}{\omega_0}\right)^2}$

$\omega = 2\pi f_{IN}$

$\omega_0 = \frac{1}{\tau}$

1kΩ of R1 is a limit resistance to prevent gain from going too high at high range and amplifier from oscillating.

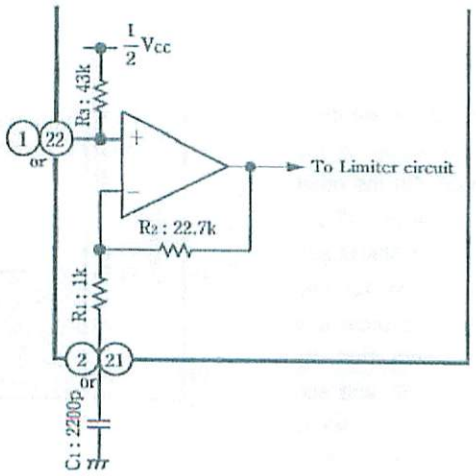


Fig. 1 Pre emphasis circuit