

# Wireless Audio Link IC

## BH1416S / BH1416F

The BH1416S/F are FM stereo transmitter ICs that transmit simple configuration. The ICs consist of a stereo modulator for generating stereo composite signals and a FM transmitter for broadcasting a FM signal on the air. The stereo modulator generates a composite signal which consists of the MAIN, SUB, and pilot signal from a 38kHz oscillator. The FM transmitter radiates FM wave on the air by modulating the carrier signal with a composite signal.

### ●Applications

Wireless speakers, Personal computer(sound board), Game machine, CD changer, Car TV, Car navigation

### ●Features

- 1) It is possible to improve the timbre because it has the pre-emphasis circuit, limiter circuit, and the low-pass filter circuit.
- 2) Built-in pilot-tone system FM stereo modulator circuit.
- 3) The transmission frequency is stable because it has a PLL system FM transmitter circuit.
- 4) PLL controls data input in parallel (4bits, 14ch).

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

Parameter	Symbol	Limits	Unit	Conditions
Supply voltage	V <sub>CC</sub>	+7.0	V	Pin8,12
Data input voltage	V <sub>IN-D</sub>	-0.3~V <sub>CC</sub> +0.3	V	Pin15,16,17,18
Phase comparator output voltage	V <sub>OUT-P</sub>	-0.3~V <sub>CC</sub> +0.3	V	Pin7
Power dissipation	BH1416S	1000	mW	
	BH1416F	450		
Storage temperature	T <sub>stg</sub>	-55~+125	°C	

\*1 Derating : 10mW/°C for operation above Ta=25°C.

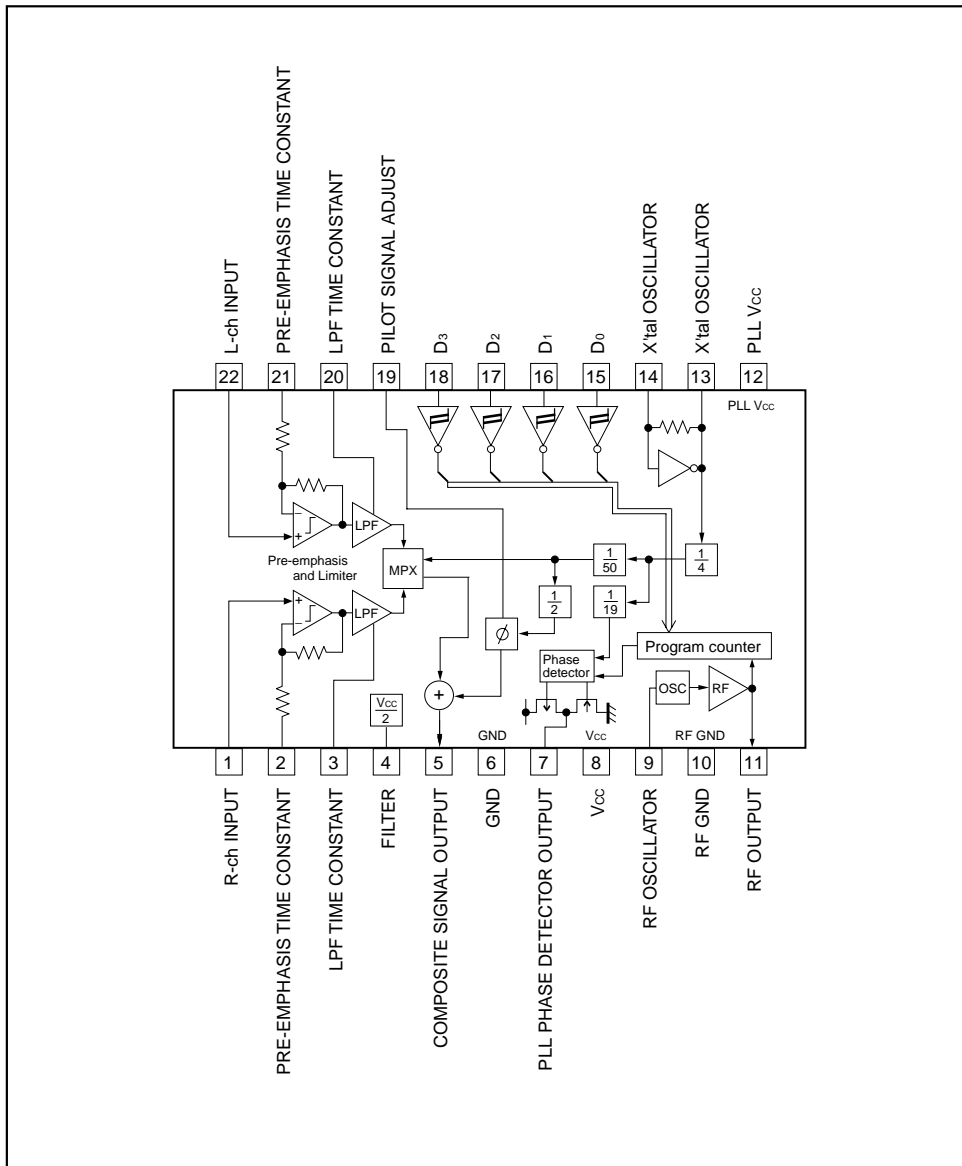
\*2 Derating : 4.5mW/°C for operation above Ta=25°C.

### ●Recommended operating conditions (Ta = 25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Operating supply voltage	V <sub>CC</sub>	4.0	-	6.0	V	Pin8,12
Operating temperature	T <sub>opr</sub>	-40	-	+85	°C	
Audio input level	V <sub>IN-A</sub>	-	-	-10	dBV	Pin1,22
Audio input frequency band	f <sub>IN-A</sub>	20	-	15k	Hz	Pin1,22
Pre-emphasis time constant set up range	τ <sub>PRE</sub>	-	-	155	μsec	Pin2,21
Transmission frequency(200kHz step)	f <sub>TX</sub>	76.8 88.0	-	78.0 89.2	MHz	Pin9,11
Control terminal "H" level input voltage	V <sub>IH</sub>	0.8V <sub>CC</sub>	-	V <sub>CC</sub>	V	Pin15,16,17,18
Control terminal "L" level input voltage	V <sub>IL</sub>	GND	-	0.2V <sub>CC</sub>	V	Pin15,16,17,18

Audio ICs

●Block diagram



Audio ICs

● Pin descriptions

Pin No.	Pin descriptions	Equivalent circuit	DC (V)
1	R-ch audio source input terminal It cuts DC with the capacitor and it inputs R-ch audio signal.		$\frac{1}{2}V_{CC}$
22	L-ch audio source input terminal It cuts DC with the capacitor and it inputs L-ch audio signal.		$\frac{1}{2}V_{CC}$
2,21	Pre-emphasis time constant terminal It connects a capacitor for the time constant of pre-emphasis. $\tau=22.7k\Omega \times C$		
3,20	LPF time constant terminal This is 15kHz LPF. It connects a 150pF capacitor.		$\frac{1}{2}V_{CC}$
4	Filter terminal It is a ripple filter for the reference voltage of the audio part.		$\frac{1}{2}V_{CC}$
5	Composite signal output terminal It connects to the FM modulator.		$\frac{1}{2}V_{CC}$
6	GND	_____	GND
7	PLL phase detector output terminal It connects to the PLL LPF circuit.		—
8	Power supply terminal	_____	Vcc

Audio ICs

Pin No.	Pin descriptions	Equivalent circuit	DC (V)
9	RF oscillator terminal  This is the base terminal of the colpitts oscillator. It connects time constant of the oscillation.		$\frac{4}{7}V_{CC}$
10	RF GND	—————	GND
11	RF transmission output terminal  It connects to the antenna through BPF.		$V_{CC} - 1.9$
12	PLL power supply terminal	—————	$V_{CC}$
13,14	X'tal oscillator terminal  It connects a 7.6MHz crystal oscillator.		—
15	Parallel data set up terminal D <sub>0</sub>		—
16	Parallel data set up terminal D <sub>1</sub>		
17	Parallel data set up terminal D <sub>2</sub>		
18	Parallel data set up terminal D <sub>3</sub>		
19	Pilot signal adjust terminal		$\frac{1}{2}V_{CC}$

## Audio ICs

**●Electrical characteristics** (Unless otherwise noted, Ta = 25°C, Vcc=5.0V Signal source : fin = 400Hz)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions	Measurement circuit
Quiescent current	I <sub>Q</sub>	14	20	28	mA		Fig.1
Channel separation	Sep	25	40	—	dB	V <sub>IN</sub> =-20dBV L→R,R→L	Fig.2
Total harmonic distortion	THD	—	0.1	0.3	%	V <sub>IN</sub> =-20dBV L+R	Fig.3
Channel balance	C.B	-2	0	+2	dB	V <sub>IN</sub> =-20dBV L+R	Fig.2
Input output gain	G <sub>v</sub>	-2	0	+2	dB	V <sub>IN</sub> =-20dBV L+R	Fig.3
Pilot modulation rate	M <sub>P</sub>	12	15	18	%	V <sub>IN</sub> =-20dBV,L+R Pin5	Fig.3
Sub carrier rejection ratio	SCR	—	-30	-20	dB	V <sub>IN</sub> =-20dBV L+R	Fig.3
Pre-emphasis time constant	τ <sub>PRE</sub>	40	50	60	μsec	V <sub>IN</sub> =-20dBV L+R	Fig.3
Limiter input level	V <sub>IN(LIM)</sub>	-16	-13	-10	dBV	Output level at 1dB gain compression	Fig.4
LPF cut off frequency	f <sub>C(LPF)</sub>	12	15	18	kHz	V <sub>O</sub> =-3dB Pin2,21 Open	Fig.5
Transmission output level	V <sub>TX</sub>	98	101	104	dBμV	f <sub>TX</sub> =89.2MHz	Fig.6
"H" level input current	I <sub>IH</sub>	—	—	1.0	μA	Pin15,16,17,18 V <sub>IN</sub> =5V	Fig.7
"L" level input current	I <sub>IL</sub>	-1.0	—	—	μA	Pin15,16,17,18 V <sub>IN</sub> =0V	Fig.7
"H" level output voltage	V <sub>OH</sub>	V <sub>CC</sub> -1.0	V <sub>CC</sub> -0.15	—	V	Pin7 I <sub>OUT</sub> =-1.0mA	Fig.8
"L" level output voltage	V <sub>OL</sub>	—	0.15	1.0	V	Pin7 I <sub>OUT</sub> =1.0mA	Fig.8
"off" level leak current1	I <sub>OFF1</sub>	—	—	100	nA	Pin7 V <sub>OUT</sub> =5V	Fig.9
"off" level leak current2	I <sub>OFF2</sub>	-100	—	—	nA	Pin7 V <sub>OUT</sub> =GND	Fig.9

Audio ICs

● Measurement circuits

Quiescent current

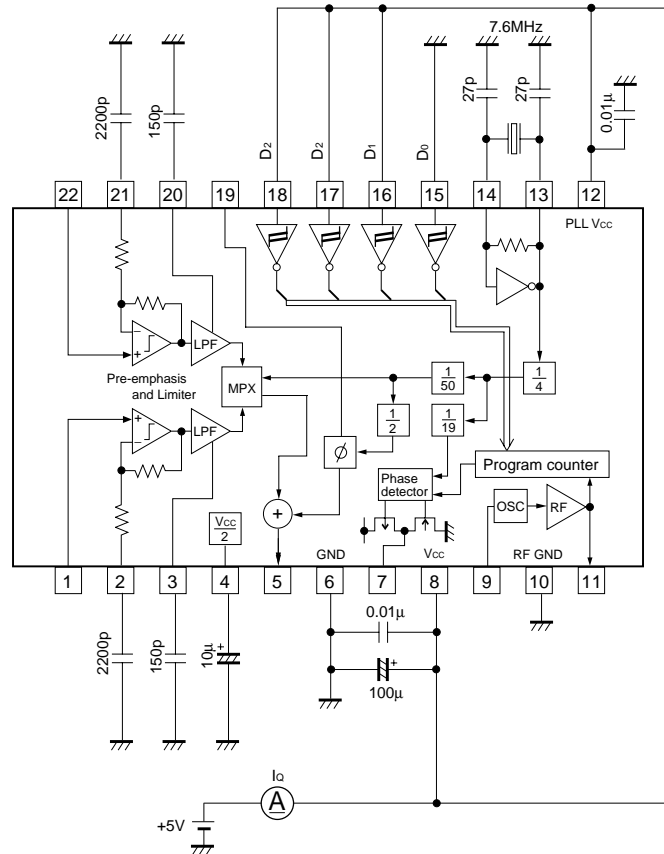


Fig.1

Audio ICs

Channel separation  
Channel balance

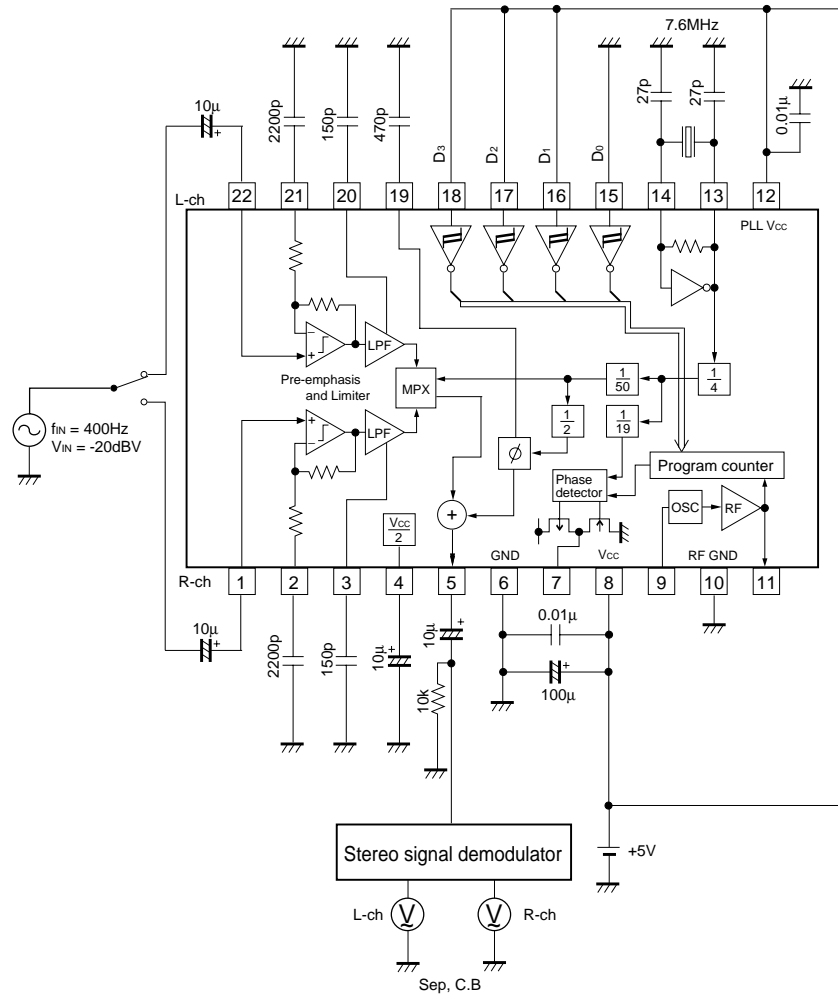


Fig.2

Audio ICs

- Total harmonic distortion
- Input output gain
- Pilot index of modulation
- Sub carrier rejection ratio
- Pre-emphasis time constant

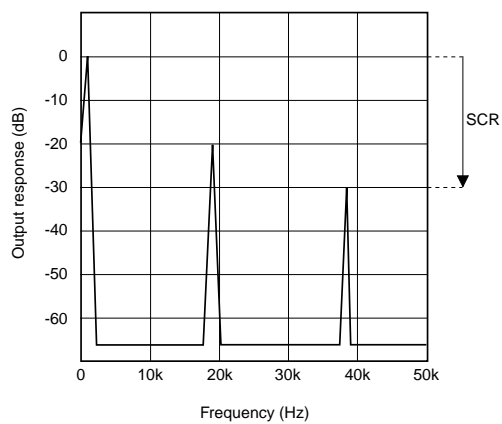
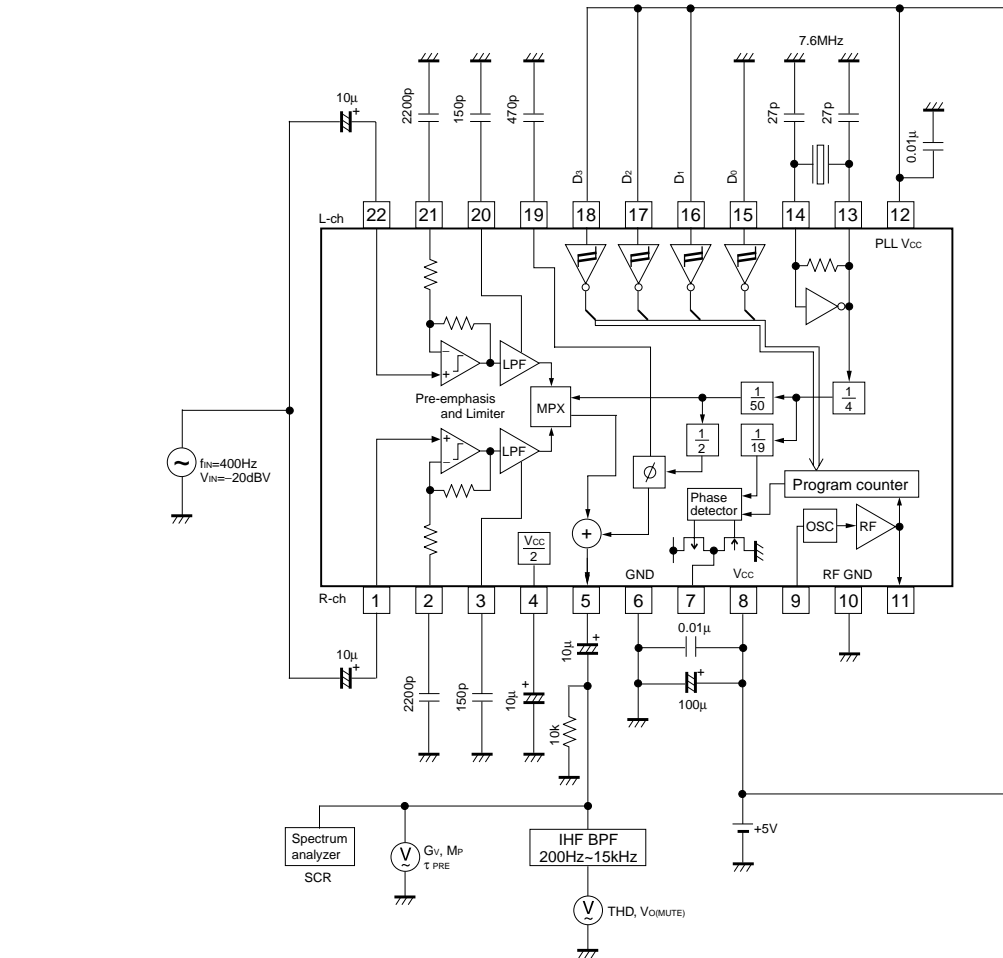


Fig.3



Audio ICs

Limiter input level

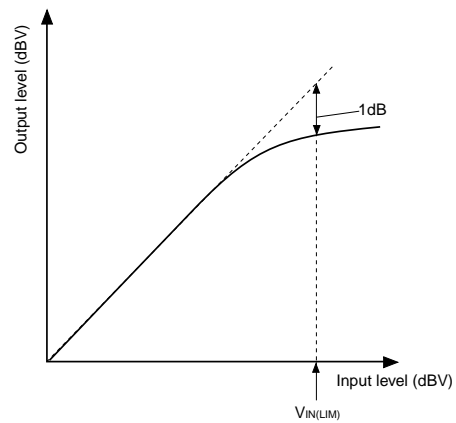
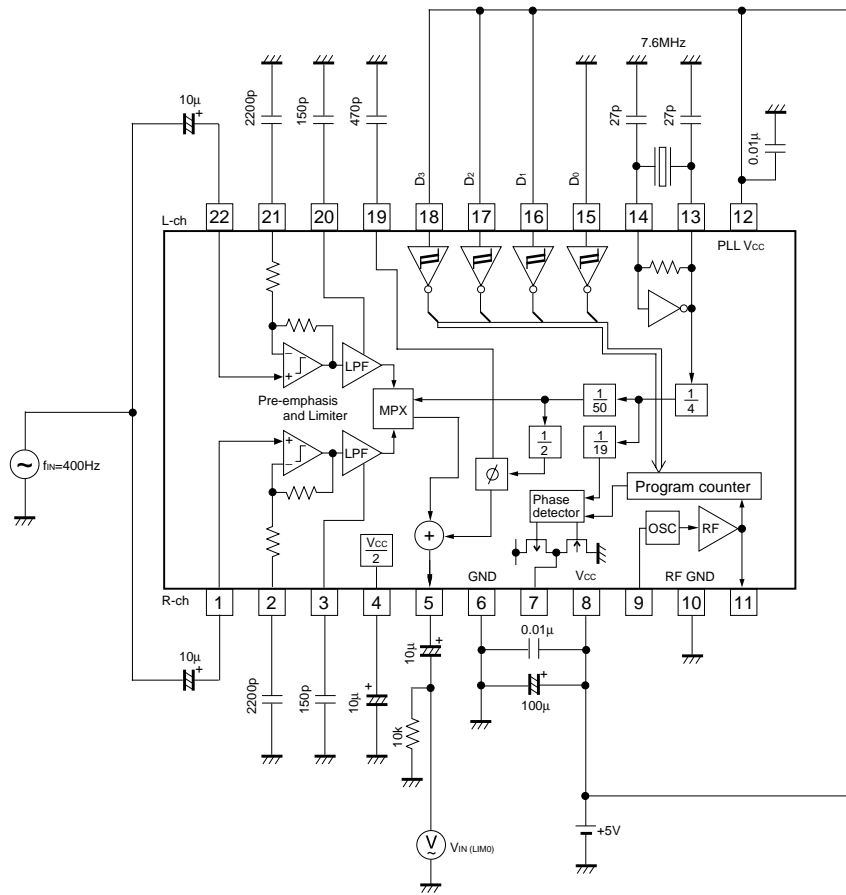


Fig.4

Audio ICs

LPF cut off frequency

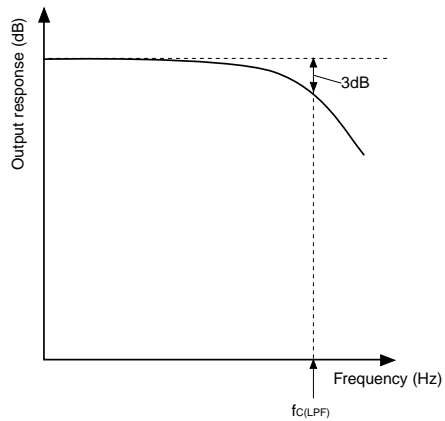
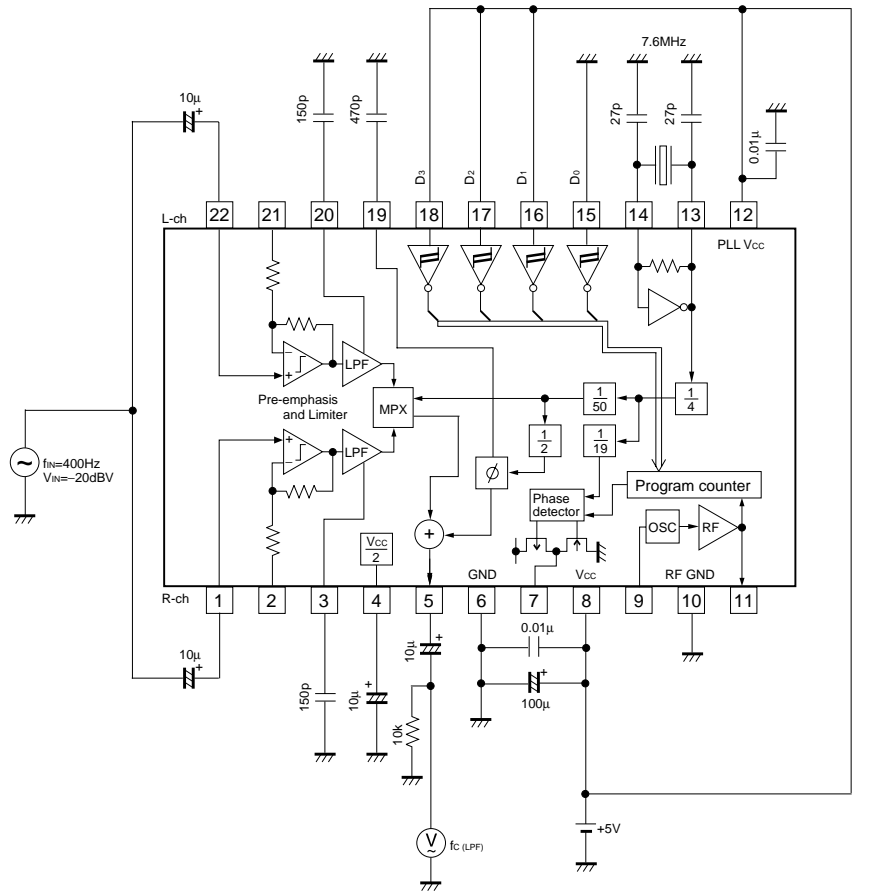


Fig.5

Audio ICs

Transmission output level

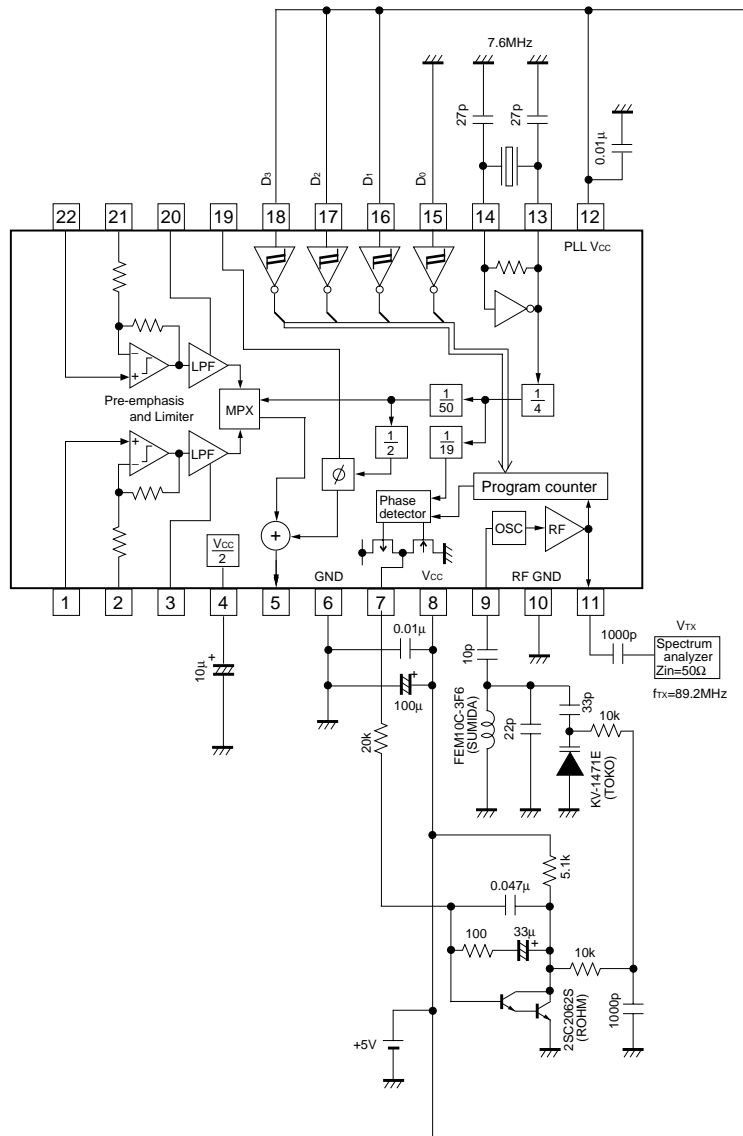


Fig.6

Audio ICs

"H" level input current  
 "L" level input current

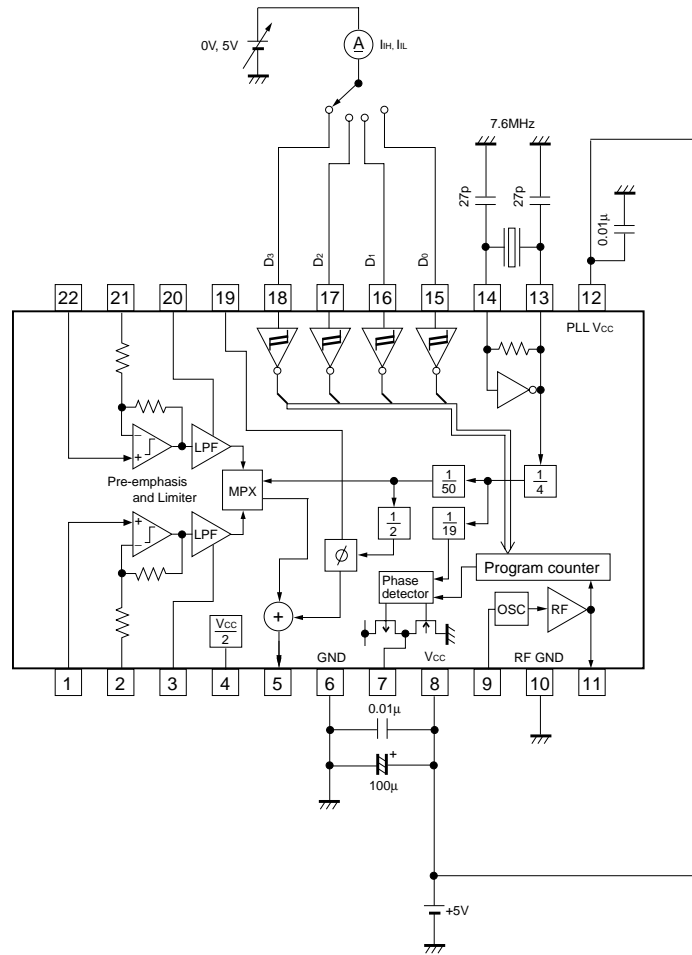


Fig.7

Audio ICs

“H” level output voltage  
 “L” level output voltage

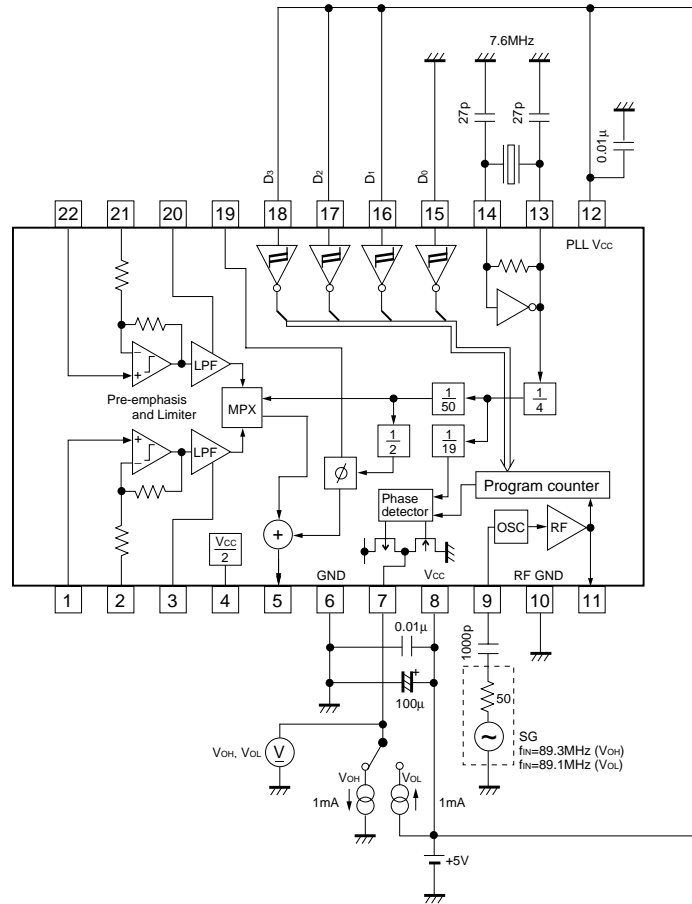


Fig.8

Audio ICs

“off” level leak input current

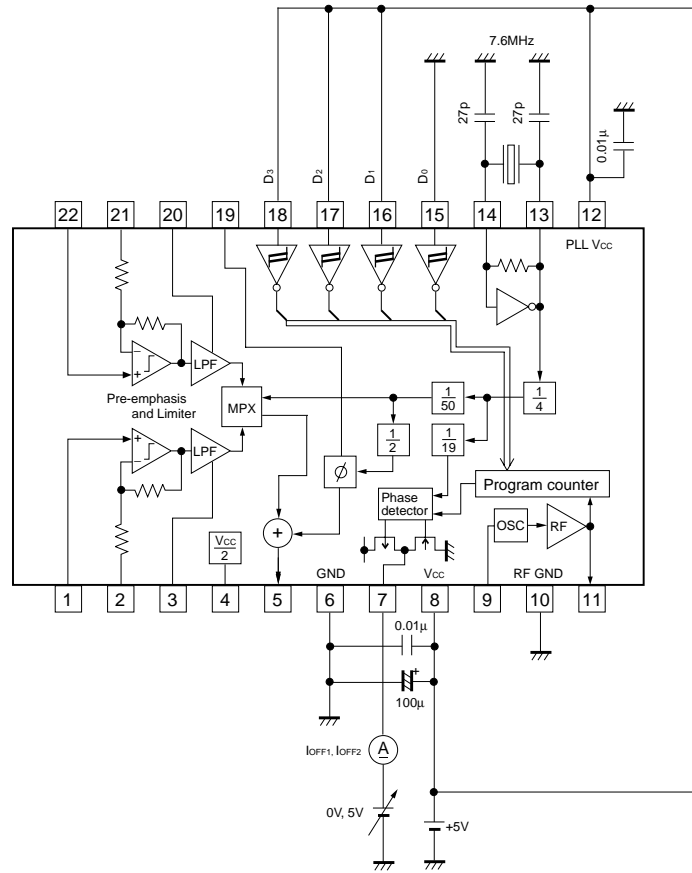


Fig.9

Audio ICs

●Circuit operation

Parallel data

Control data				Frequency
D <sub>0</sub> (Pin15)	D <sub>1</sub> (Pin16)	D <sub>2</sub> (Pin17)	D <sub>3</sub> (Pin18)	
L	L	L	L	76.8MHz
H	L	L	L	77.0MHz
L	H	L	L	77.2MHz
H	H	L	L	77.4MHz
L	L	H	L	77.6MHz
H	L	H	L	77.8MHz
L	H	H	L	78.0MHz
H	H	H	L	PLL stops. Phase comparator terminal supports high impedance.
L	L	L	H	88.0MHz
H	L	L	H	88.2MHz
L	H	L	H	88.4MHz
H	H	L	H	88.6MHz
L	L	H	H	88.8MHz
H	L	H	H	89.0MHz
L	H	H	H	89.2MHz
H	H	H	H	PLL stops. Phase comparator terminal supports high impedance.

●External dimensions (Units : mm)

