Wireless Audio Link IC

BH1415S / BH1415F

The BH1415S/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

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

●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 data input (CE, CK, DA) by serial input.

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

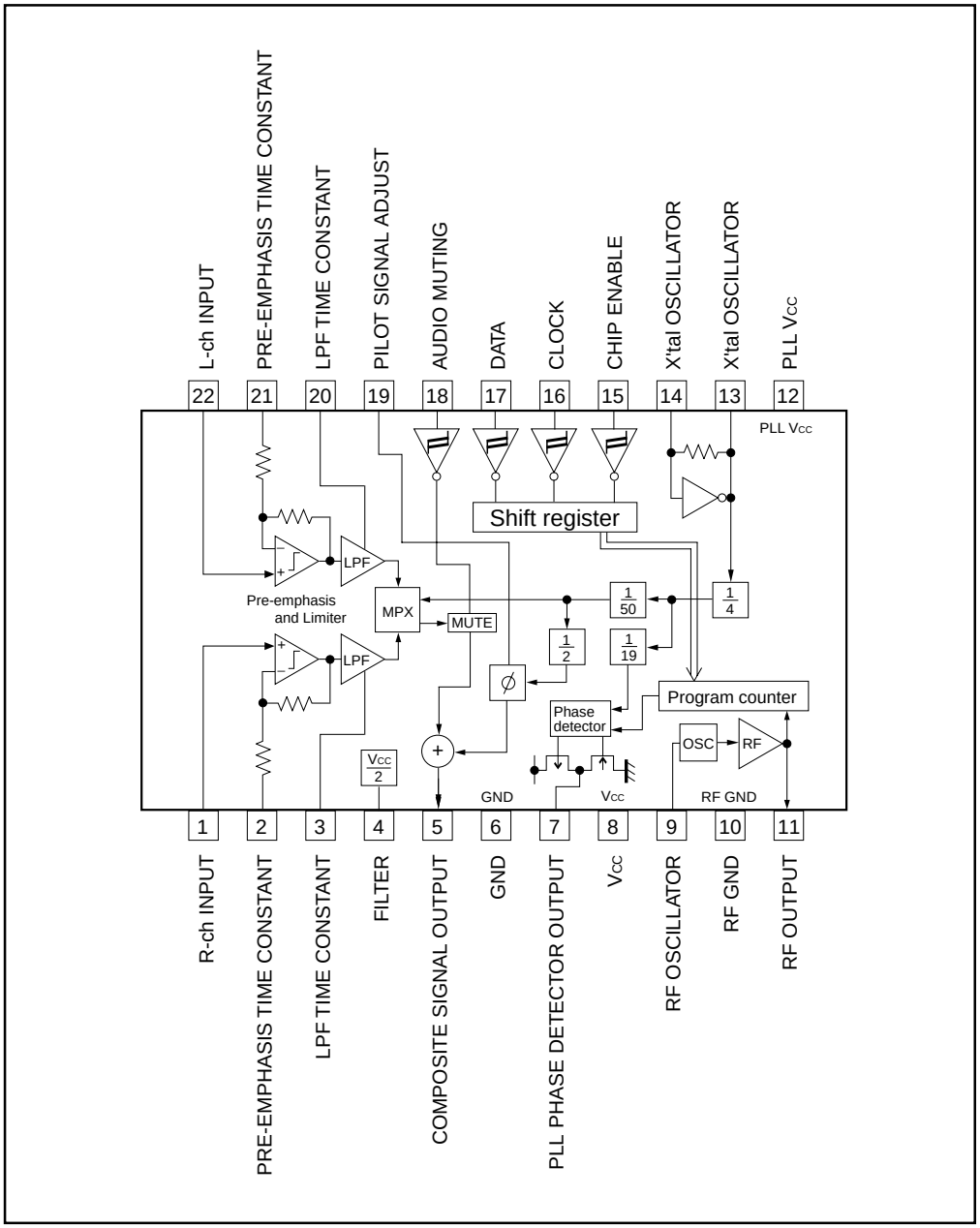
Parameter		Symbol	Limits	Unit	Conditions
Supply voltage		Vcc	+7.0	V	Pin8,12
Data input voltage		V_{IN-D}	–0.3～Vcc+0.3	V	Pin15,16,17,18
Phase comparator output voltage		V_{OUT-P}	–0.3～Vcc+0.3	V	Pin7
Power dissipation	BH1415S	Pd	1000 ∗1	mW	
	BH1415F		450 ∗2		
Storage temperature		Tstg	–55～+125	˚C	

*1 Derating : 10mW/˚C for operation above Ta=25˚C.
*2 Derating : 4.5mW/˚C for operation above Ta=25˚C.

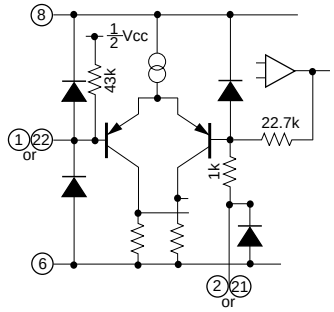
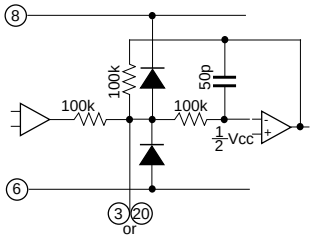
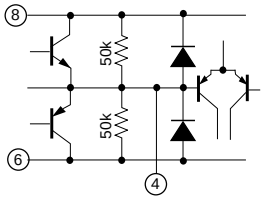
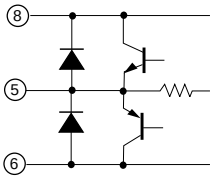
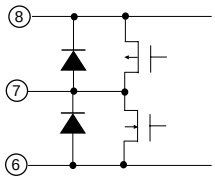
●Recommended operating conditions (Ta=25°C)

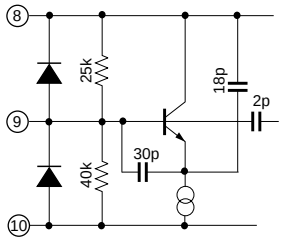
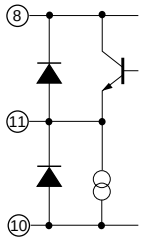
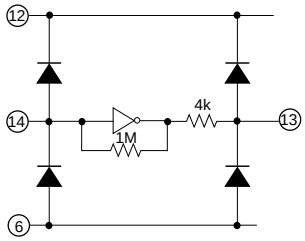
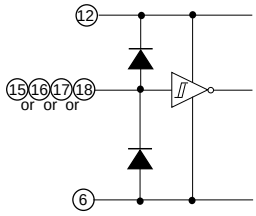
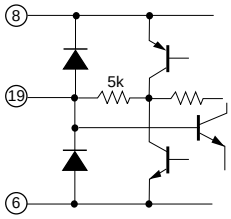
Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Operating supply voltage	Vcc	4.0	–	6.0	V	Pin8,12
Operating temperature	Topr	–4.0	–	+85	°C	
Audio input level	V_{IN-A}	–	–	–10	dBV	Pin1,22
Audio input frequency band	f_{IN-A}	20	–	15k	Hz	Pin1,22
Pre-emphasis time constant set up range	τ_{PRE}	–	–	155	μsec	Pin2,21
Transmission frequency	f_{TX}	70	–	120	MHz	Pin9,11
Control terminal "H" level input voltage	V_{IH}	0.8Vcc	–	Vcc	V	Pin15,16,17,18
Control terminal "L" level input voltage	V_{IL}	GND	–	0.2Vcc	V	Pin15,16,17,18

●**Block diagram**



●**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.		1/2Vcc
22	L-ch audio source input terminal It cuts DC with the capacitor and it inputs L-ch audio signal.		
2,21	Pre-emphasis time constant terminal It connects a capacitor for the time constant of pre-emphasis. $\tau = 22.7k\Omega \times C$		1/2Vcc
3,20	LPF time constant terminal This is 15kHz LPF. It connects a 150pF capacitor.		1/2Vcc
4	Filter terminal It is a ripple filter for the reference voltage of the audio part.		1/2Vcc
5	Composite signal output terminal It connects to the FM modulator.		1/2Vcc
6	GND	–	GND
7	PLL phase detector output terminal It connects to the PLL LPF circuit.		–
8	Power supply terminal	–	Vcc

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.		$\frac{4}{7}$Vcc
10	RF GND	–	GND
11	RF transmission output terminal It connects to the antenna through BPF.		Vcc -1.9
12	PLL power supply terminal	–	Vcc
13,14	X'tal oscillator terminal It connects a 7.6MHz crystal oscillator.		–
15	Chip enable terminal The terminal to make high level in serial data input.		–
16	Clock input terminal The clock which takes data and synchronization in serial data input.		
17	Data input terminal The input terminal of the serial data which is forwarded from the controller		
18	Audio mute terminal 0.8Vcc ≤ Pin18 : Mute ON 0.2Vcc ≥ Pin18 : Mute OFF		
19	Pilot signal adjust terminal		$\frac{1}{2}$Vcc

●**Electrical characteristics** (Unless otherwise noted Ta = 25°C, V_{CC}=5.0V, Signal source : f_{IN}=400Hz)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions	Measurement circuit
Quiescent current	I_Q	14	20	28	mA		Fig.1
Channel separation	Sep	25	40	–	dB	V_{IN}=–20dBV L→R,R→L	Fig.2
Total harmonic distortion	THD	–	0.1	0.3	%	V_{IN}=–20dBV L+R	Fig.3
Channel balance	C.B	–2	0	+2	dB	V_{IN}=–20dBV L+R	Fig.2
Input output gain	Gv	–2	0	+2	dB	V_{IN}=–20dBV L+R	Fig.3
Pilot modulation rate	M_P	12	15	18	%	V_{IN}=–20dBV,L+R Pin5	Fig.3
Sub carrier rejection ratio	SCR	–	–30	–20	dB	V_{IN}=–20dBV L+R	Fig.3
Pre-emphasis time constant	τ_{PRE}	40	50	60	µsec	V_{IN}=–20dBV L+R	Fig.3
Limiter input level	$V_{IN(LIM)}$	–16	–13	–10	dBV	Output level at 1dB gain compression	Fig.4
LPF cut off frequency	$f_{C(LPF)}$	12	15	18	kHz	V_O=–3dB Pin2,21Open	Fig.5
Mute attenuation volume	$V_{O(MUTE)}$	–	–48	–42	dB	V_{IN}=–20dBV L+R	Fig.3
Transmission output level	V_{TX}	97	100	103	dBµV	f_{TX}=100MHz	Fig.6
"H" level input current	I_{IH}	–	–	1.0	µA	Pin15,16,17,18 V_{IN}=5V	Fig.7
"L" level input current	I_{IL}	–1.0	–	–	µA	Pin15,16,17,18 V_{IN}=0V	Fig.7
"H" level output voltage	V_{OH}	Vcc–1.0	Vcc–0.15	–	V	Pin7 I_{OUT}=–1.0mA	Fig.7
"L" level output voltage	V_{OL}	–	0.15	1.0	V	Pin7 I_{OUT}=1.0mA	Fig.7
"off" level leak current1	I_{OFF1}	–	–	100	nA	Pin7 V_{OUT}=5V	Fig.8
"off" level leak current2	I_{OFF2}	–100	–	–	nA	Pin7 V_{OUT}=GND	Fig.8

●**Measurement circuits**

Quiescent current

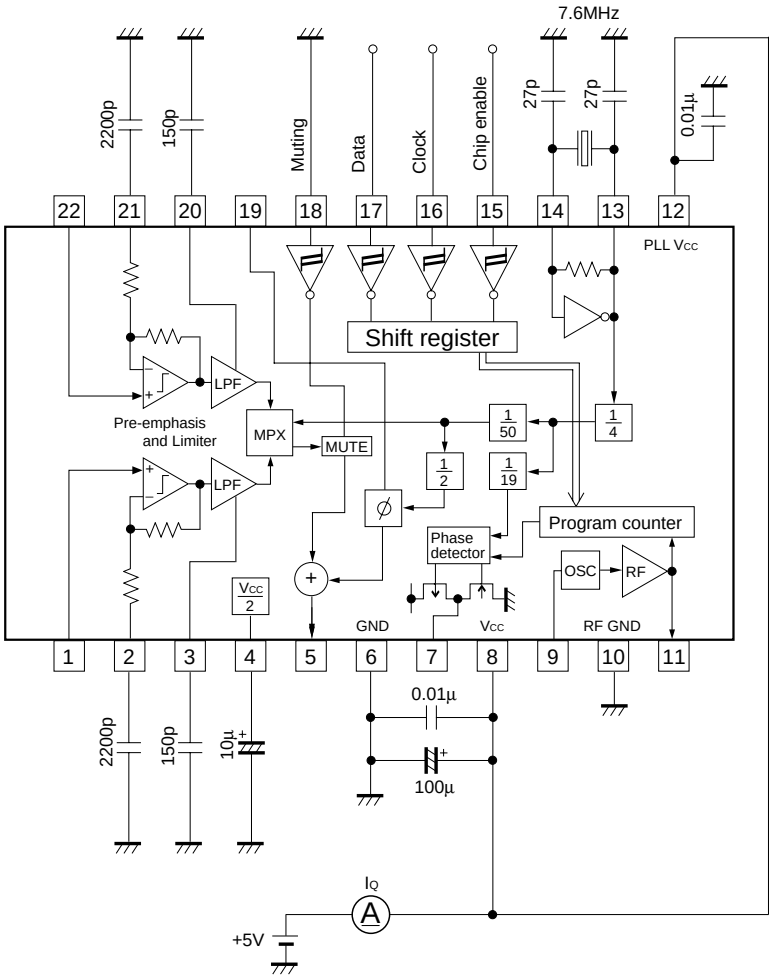


Fig.1

Channel separation
Channel balance

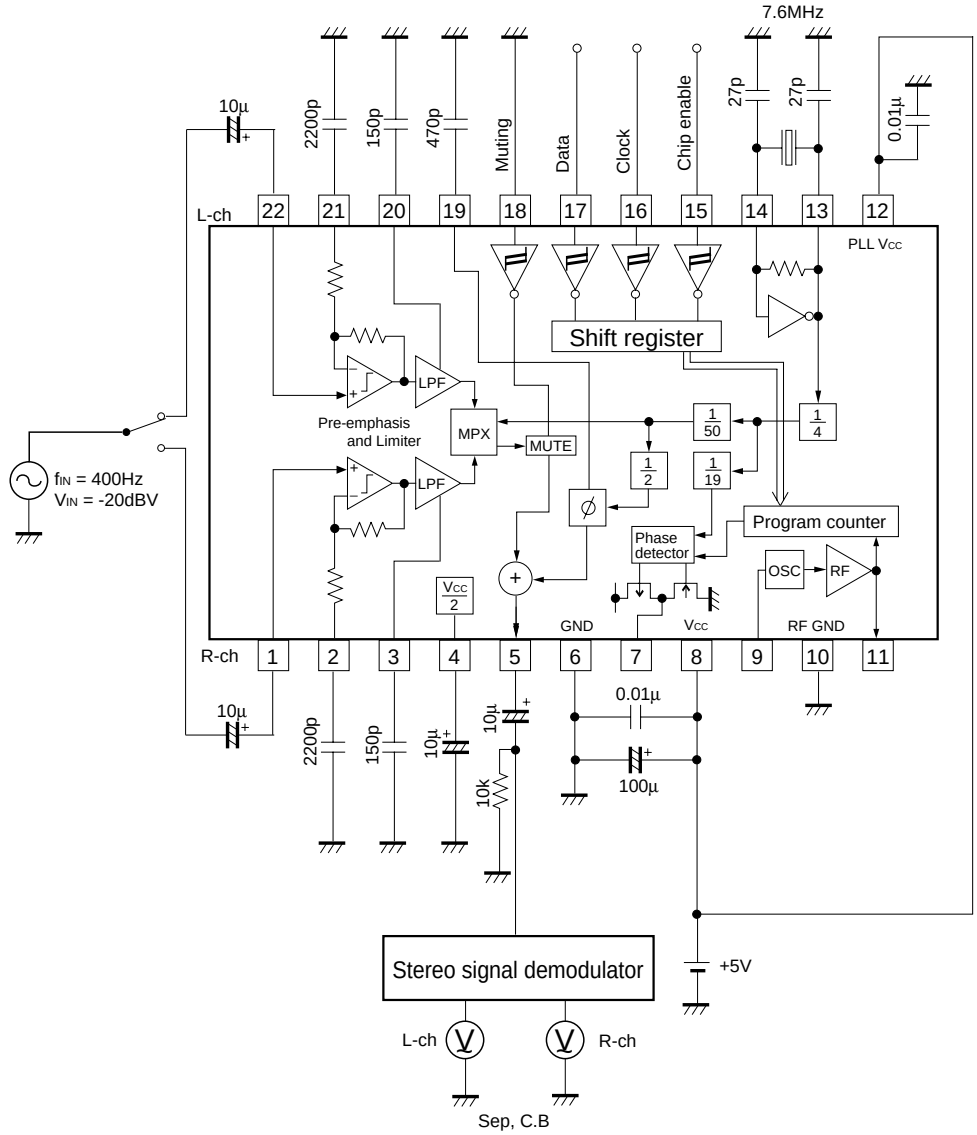
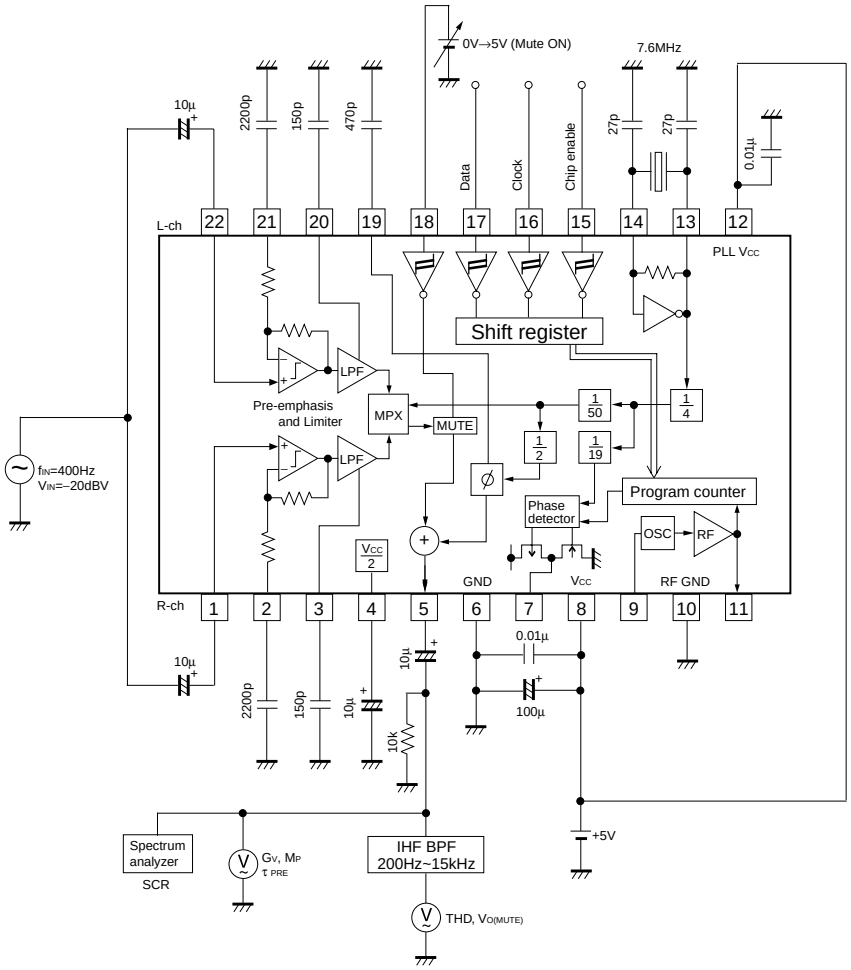


Fig.2

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



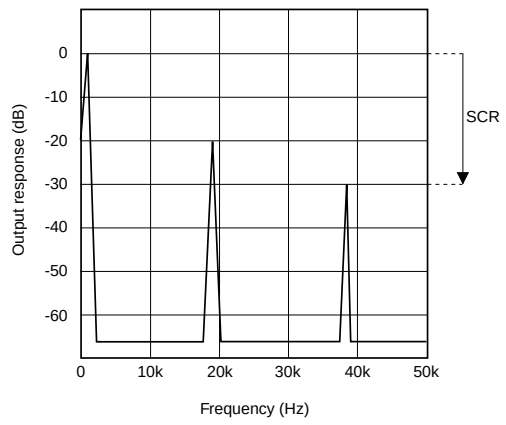
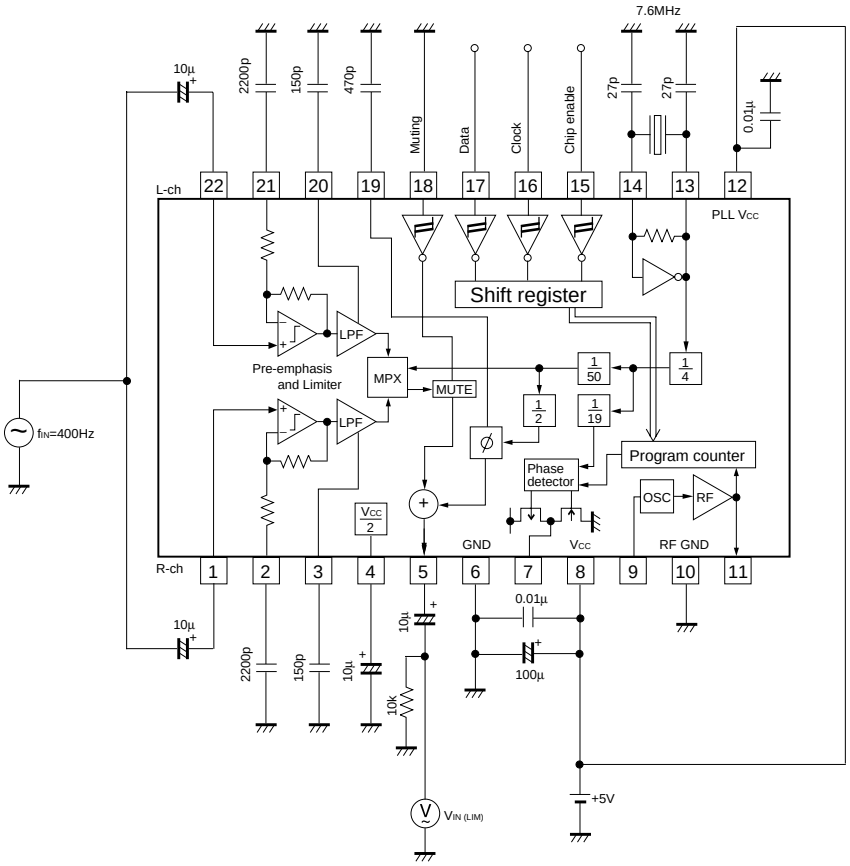


Fig.3

Limiter input level



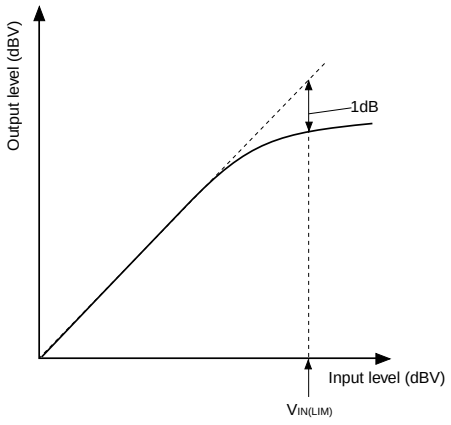
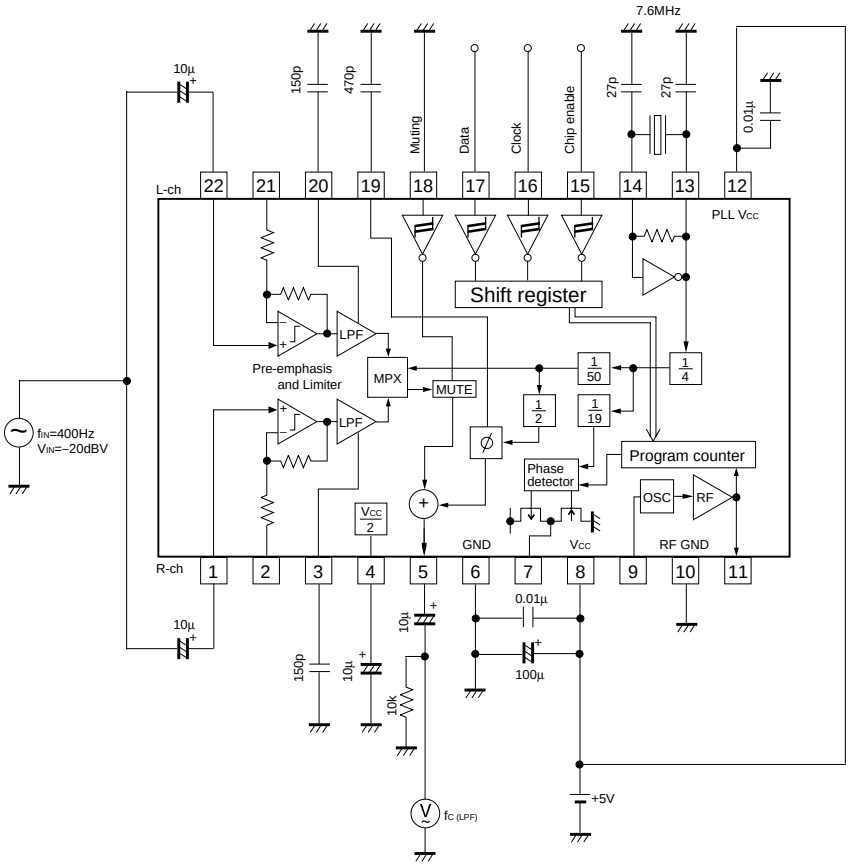


Fig.4

LPF cut off frequency



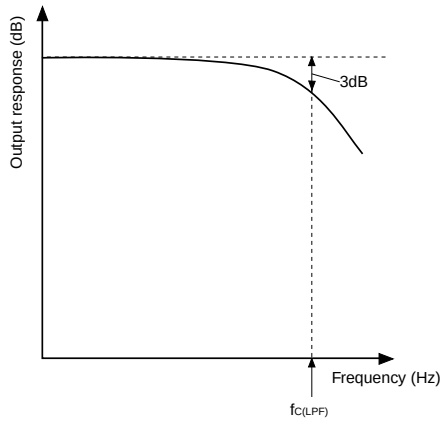


Fig.5

Transmission output level

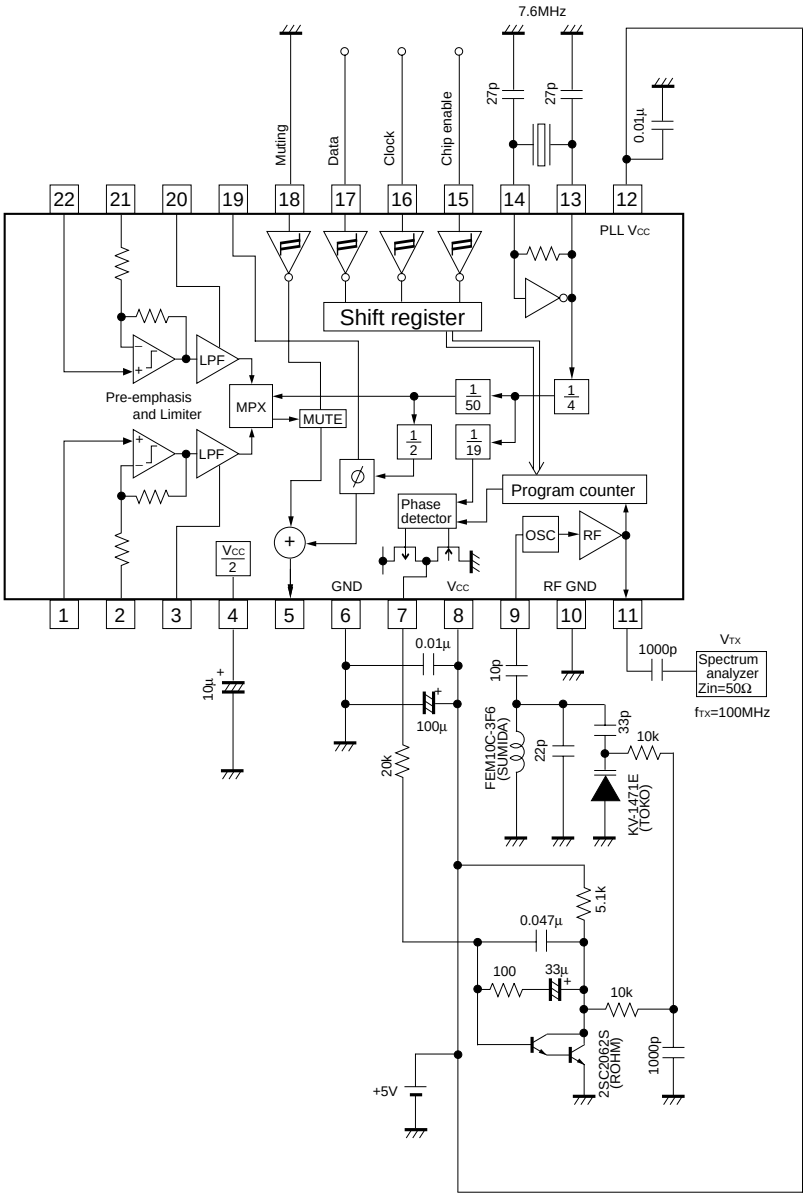


Fig.6

"H" level input current
"L" level input current
"H" level output voltage
"L" level output voltage

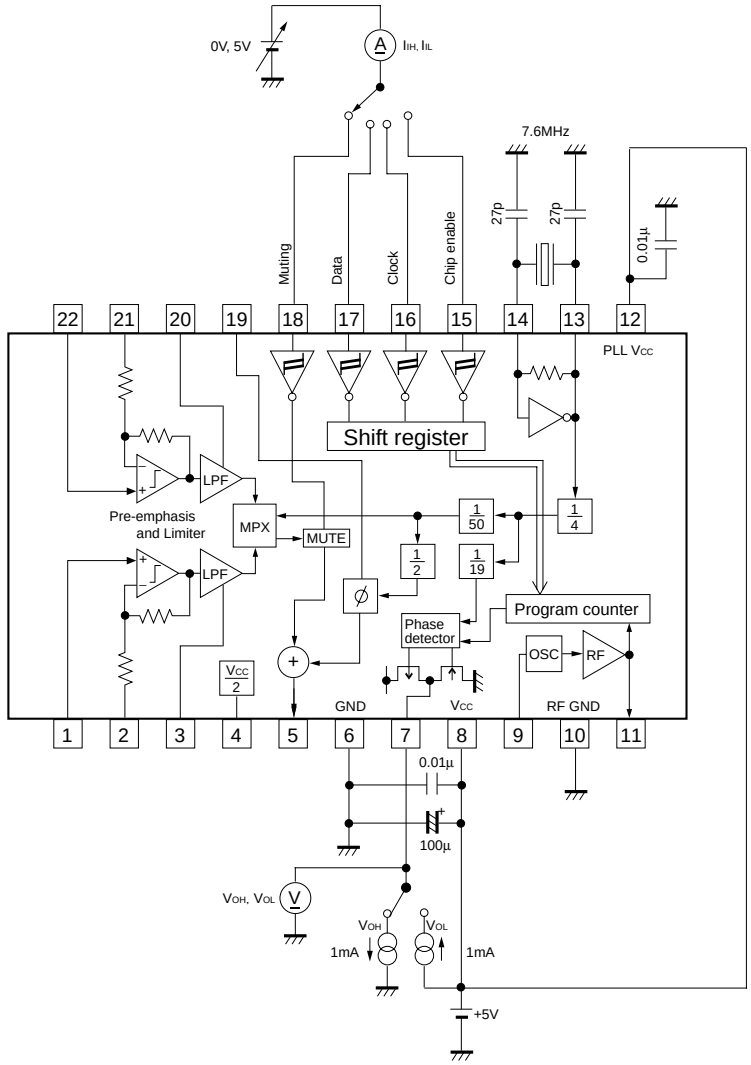


Fig.7

"off " level leak input current

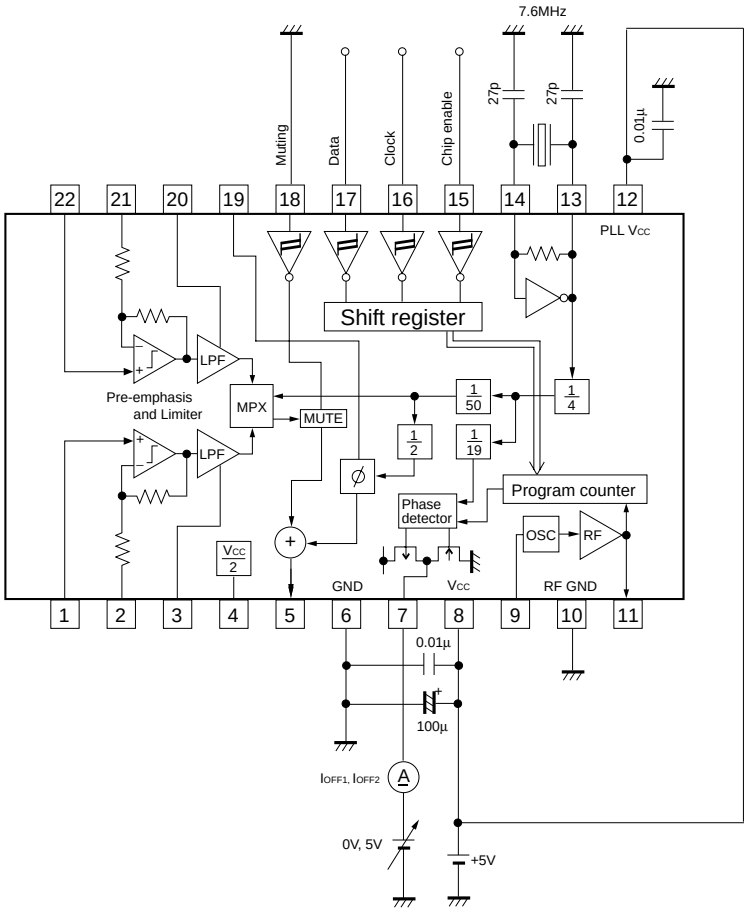
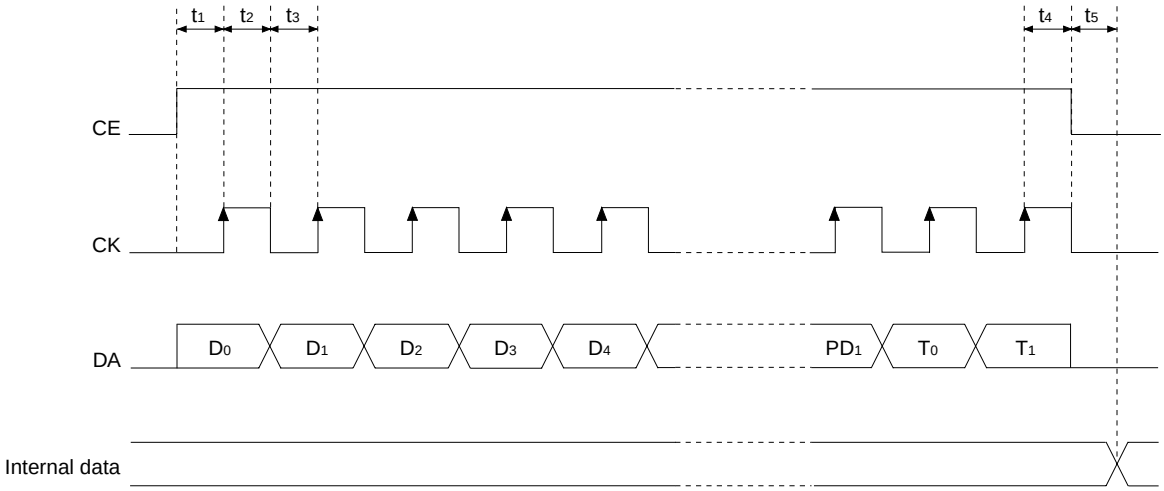


Fig.8

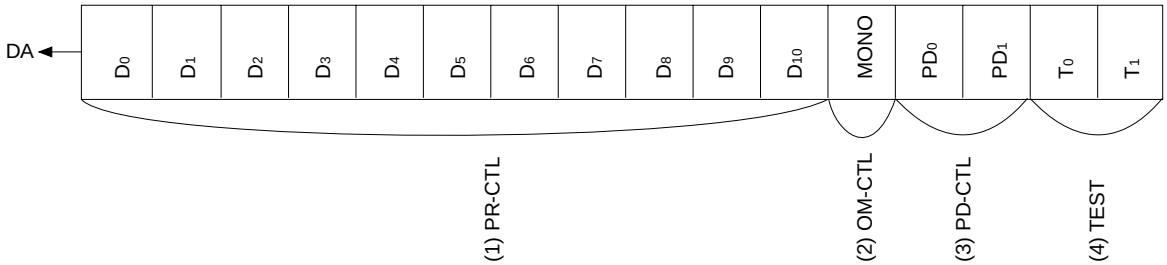
●Circuit operations

Input of the serial data

$t_1, t_2, t_3, t_4 \geq 1.5\mu sec$
$t_5 < 1.5\mu sec$ (X'tal : 7.6MHz)

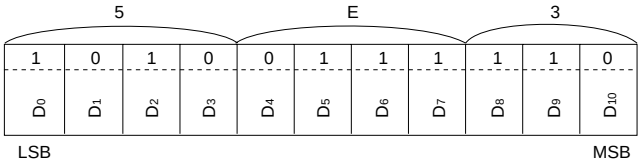


Composition of the serial data



Explanation of the serial data

No.	Control unit / Data	Contents
(1)	PROGRAM COUNTER $D_0 \sim D_{10}$	· It is the data which sets the program counter number of the dividing.This data can set a transmission frequency. · It is a binary value. It sets D_{10} with MSB and it sets D_0 with LSB. Example In case of 99.7MHz oscillation 99.7MHz ÷ 100kHz(fref) = 997 → 3E5(HEX)



<table>
<tr><th>No.</th><th>Control unit / Data</th><th>Contents</th></tr>
<tr><td>(2)</td><td>MULTIPLEXER

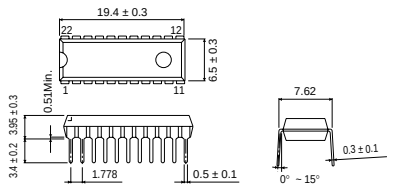
MONO</td><td>• It changes a stereo and monaural operation.
<table>
<tr><th>MONO</th><th>Condition of the composite signal</th></tr>
<tr><td>0</td><td>Monaural operation L+R , Pilot OFF</td></tr>
<tr><td>1</td><td>Stereo operation L+R+(L-R),sinω_St+Psin $\frac{\omega_S}{2}$ t</td></tr>
</table></td></tr>
<tr><td>(2)</td><td>PHASE DETECTOR

PD_0, PD_1</td><td>• It controls charge pump output by the phase comparator compulsorily.
<table>
<tr><th>PD_0</th><th>PD_1</th><th>Charge pump output</th></tr>
<tr><td>0</td><td>0</td><td>Usual operation</td></tr>
<tr><td>0</td><td>1</td><td>Compulsion by Low</td></tr>
<tr><td>1</td><td>0</td><td>Compulsion by High</td></tr>
<tr><td>1</td><td>1</td><td>High impedance</td></tr>
</table></td></tr>
<tr><td>(3)</td><td>TEST MODE

T_0, T_1</td><td>• It is data for the LSI test.
• Always in T_0 Input "1".
• Always in T_1 Input "0".</td></tr>
</table>

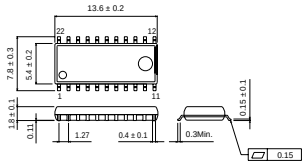
●**External dimensions** (Units : mm)

BH1415S



SDIP22

BH1415F



SOP22