

12-2054

Operational description:

This product is a FM transmitter. It obtains an audio signal from the portable audio sources (e.g. MP3 players) and then transmits it via one of the FM channels: 88.1, 88.3, 88.5, 88.7, 107.1, 107.3, 107.5, 107.7 MHz. The audio signal is firstly enhanced by pre-emphasis and low-pass filtering process to ensure low distortion at the receiver's end. Then it is mixed with oscillating frequency, modulated into FM format and further amplified. Lastly, it is transmitted out via the audio input cord, which acts as an antenna in the unit. All the processes are done by a single chip IC BH1417F (U1) in the unit.

Besides, the oscillation frequency is generated by built-in oscillator of U1 with connected to L1, L2, C18, C19 & D1 (at 107MHz) and change to 88MHz when C48 / D12 added, the HI(107MHz) or LOW(88MHz) bands can be control by the band selection switch which is connect to IC BH1417F (U1) PIN18. A mono or stereo FM radio can be used to listen to the selected FM channel. The channel selection in the unit is done by firstly selecting HI(107MHz)/LOW(88MHz) bands and then selecting the desired channel (1 to 4) which is connect to IC BH1417F (U1) PIN15 to PIN17. 2 x "AAA" batteries and CLA can be used to power up this product and an amber LED is used to indicate the ON/OFF status of the product.

Wireless Audio Link IC

BH1417F

The BH1417F is a FM stereo transmitter IC that transmits simple configuration. The IC consists 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. Frequency is set for North America.

●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 for North America).

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

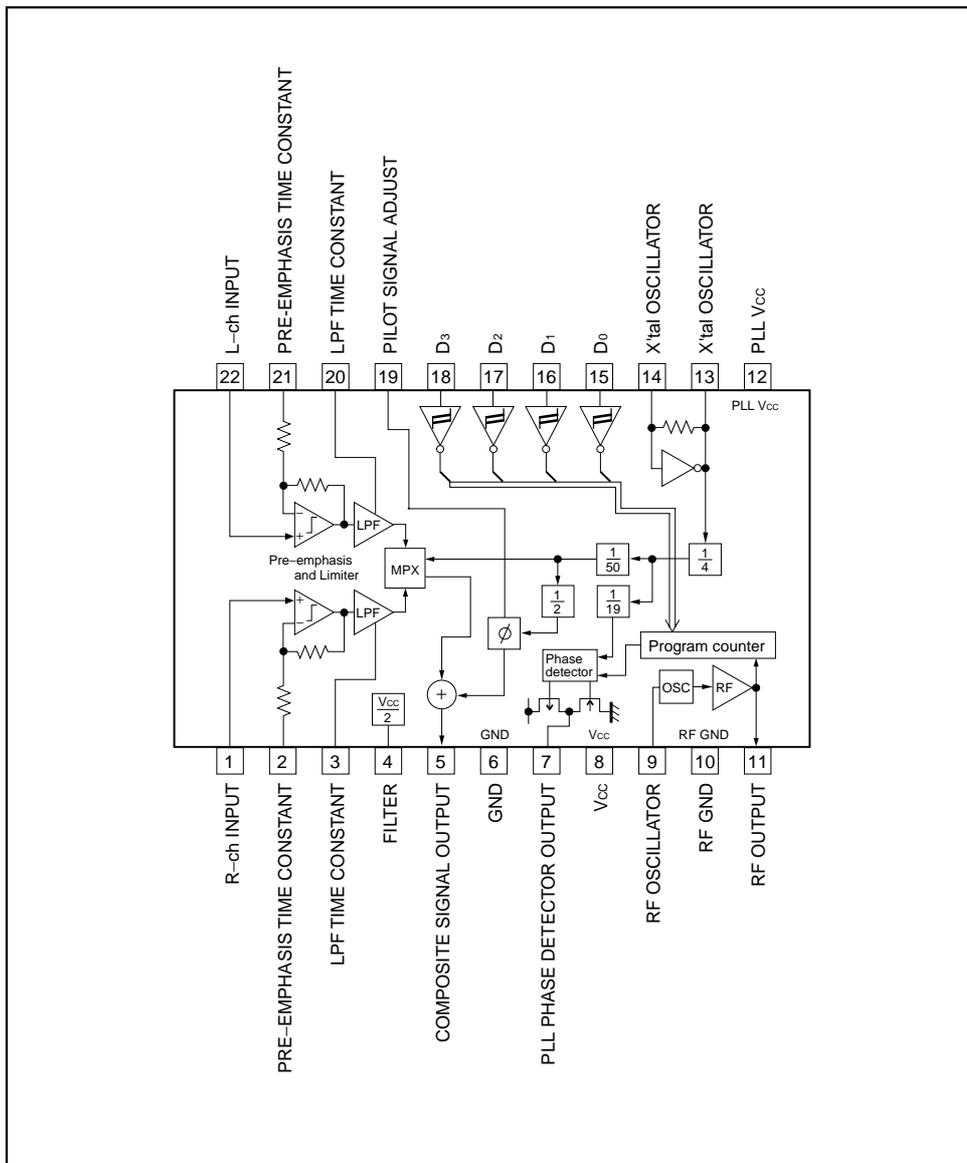
Parameter	Symbol	Limits	Unit	Conditions
Supply voltage	V _{CC}	+7.0	V	Pin8,12
Date input voltage	V _{IN-D}	-0.3~V _{CC} +0.3	V	Pin15,16,17,18
Phase comparator output voltage	V _{OUT-P}	-0.3~V _{CC} +0.3	V	Pin7
Power dissipation	P _d	450*	mW	
Storage temperature	T _{stg}	-55~+125	°C	

* 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 _{CC}	4.0	–	6.0	V	Pin8,12
Operating temperature	T _{opr}	-40	–	+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	μs	Pin2,21
Transmission frequency(200kHz step)	f _{TX}	87.7 106.7	–	88.9 107.9	MHz	Pin9,11
Control terminal "H" level input voltage	V _{IH}	0.8V _{CC}	–	V _{CC}	V	Pin15,16,17,18
Control terminal "L" level input voltage	V _{IL}	GND	–	0.2V _{CC}	V	Pin15,16,17,18

●Block diagram



Multimedia 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. $\tau=22.7k\Omega \times C$		$\frac{1}{2}V_{CC}$
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	—	V_{CC}

Multimedia 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 ₀		—
16	Parallel data set up terminal D ₁		
17	Parallel data set up terminal D ₂		
18	Parallel data set up terminal D ₃		
19	Pilot signal adjust terminal		$\frac{1}{2}V_{CC}$

Multimedia ICs

●Electrical characteristics (Unless otherwise noted, $T_a = 25^\circ\text{C}$, $V_{CC} = 5.0\text{V}$ Signal source : $f_{IN} = 400\text{Hz}$)

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	$V_{IN} = -20\text{dBV}$ $L \rightarrow R, R \rightarrow L$	Fig.2
Total harmonic distortion	THD	—	0.1	0.3	%	$V_{IN} = -20\text{dBV}$ $L+R$	Fig.3
Channel balance	C.B	-2	0	+2	dB	$V_{IN} = -20\text{dBV}$ $L+R$	Fig.2
Input output gain	G_V	-2	0	+2	dB	$V_{IN} = -20\text{dBV}$ $L+R$	Fig.3
Pilot modulation rate	M_P	12	15	18	%	$V_{IN} = -20\text{dBV}, L+R$ Pin5	Fig.3
Sub carrier rejection ratio	SCR	—	-30	-20	dB	$V_{IN} = -20\text{dBV}$ $L+R$	Fig.3
Pre-emphasis time constant	τ_{PRE}	40	50	60	μs	$V_{IN} = -20\text{dBV}$ $L+R$	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	$V_O = -3\text{dB}$ Pin2,21 Open	Fig.5
Transmission output level	V_{TX}	96	99	102	dB μV	$f_{TX} = 107.9\text{MHz}$	Fig.6
"H" level input current	I_{IH}	—	—	1.0	μA	Pin15,16,17,18 $V_{IN} = 5\text{V}$	Fig.7
"L" level input current	I_{IL}	-1.0	—	—	μA	Pin15,16,17,18 $V_{IN} = 0\text{V}$	Fig.7
"H" level output voltage	V_{OH}	$V_{CC} - 1.0$	$V_{CC} - 0.15$	—	V	Pin7 $I_{OUT} = -1.0\text{mA}$	Fig.8
"L" level output voltage	V_{OL}	—	0.15	1.0	V	Pin7 $I_{OUT} = 1.0\text{mA}$	Fig.8
"off" level leak current1	I_{OFF1}	—	—	100	nA	Pin7 $V_{OUT} = 5\text{V}$	Fig.9
"off" level leak current2	I_{OFF2}	-100	—	—	nA	Pin7 $V_{OUT} = \text{GND}$	Fig.9

Multimedia ICs

● Measurement circuits

Quiescent current

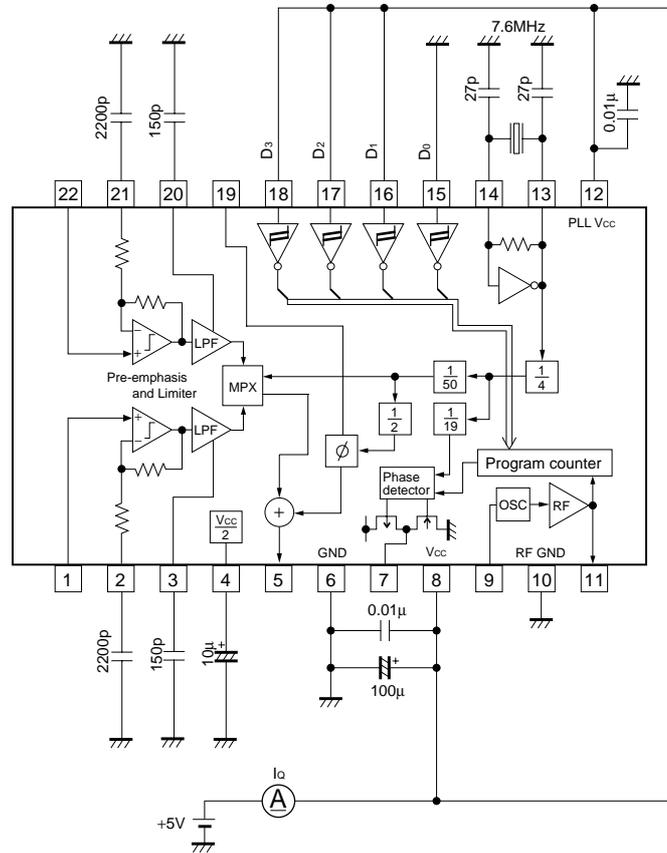


Fig.1

Multimedia ICs

Channel separation
Channel balance

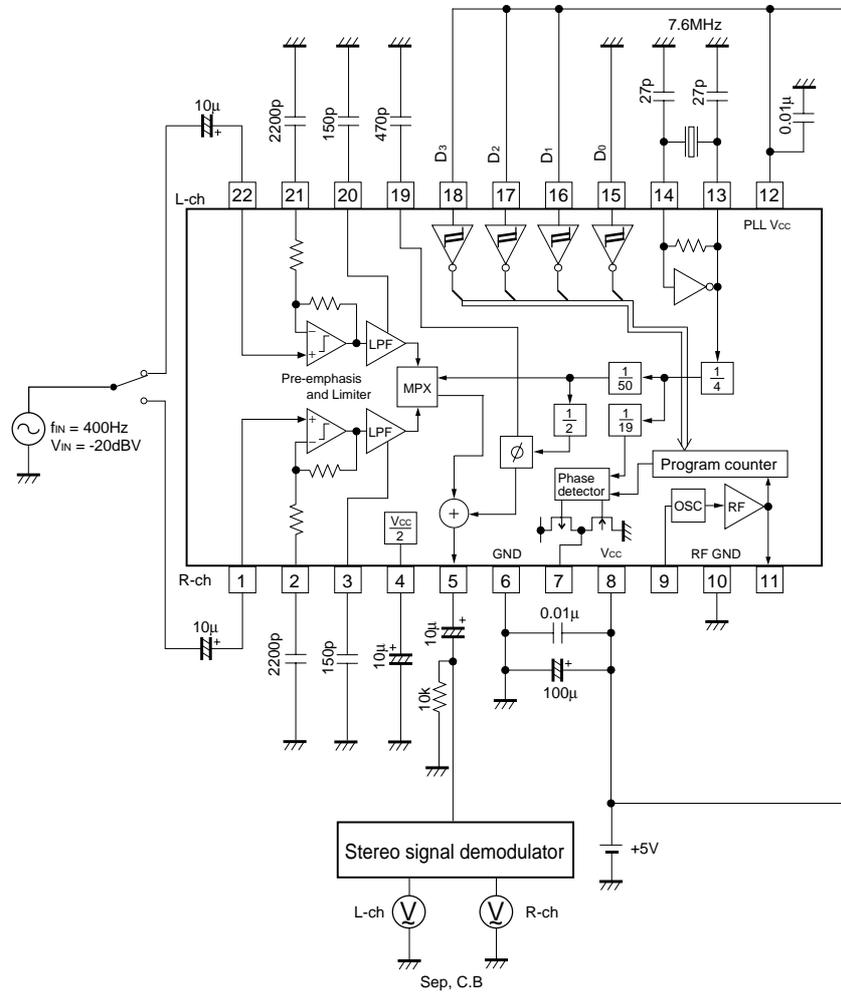


Fig.2

Limiter input level

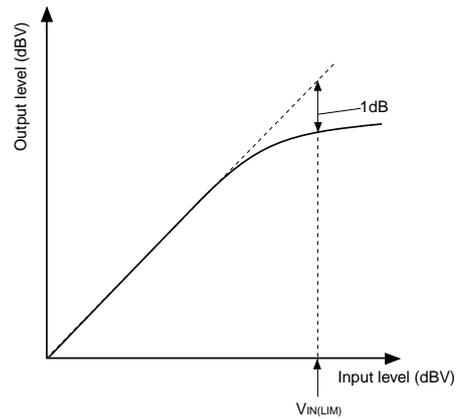
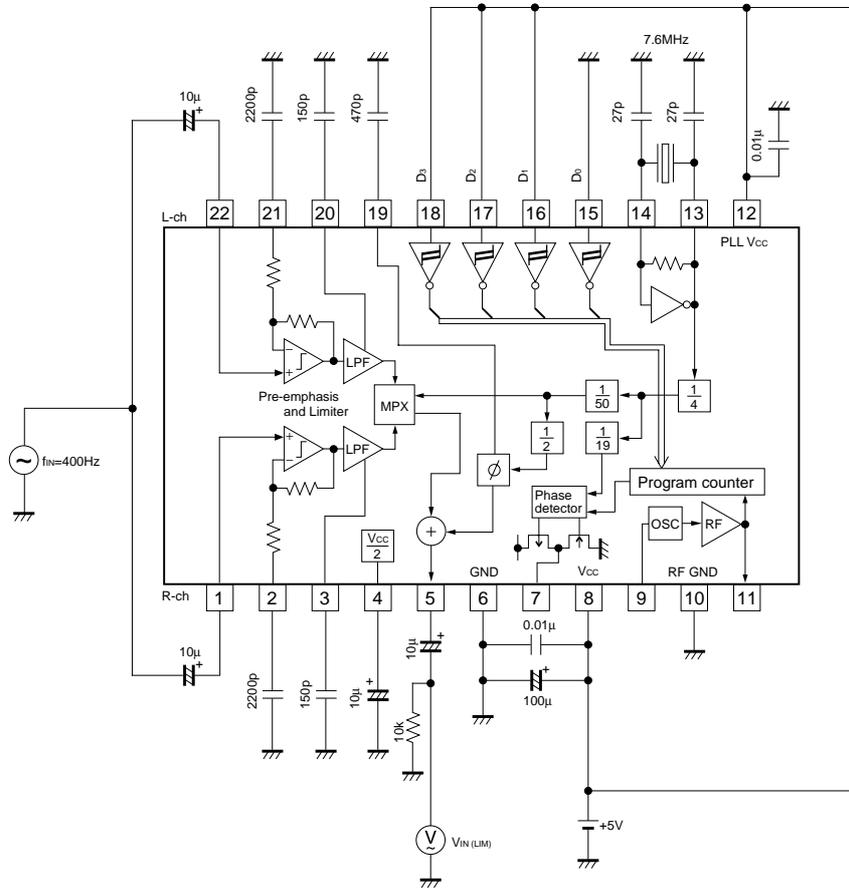


Fig.4

Multimedia ICs

LPF cut off frequency

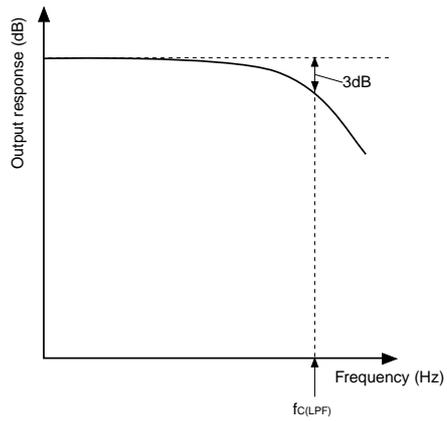
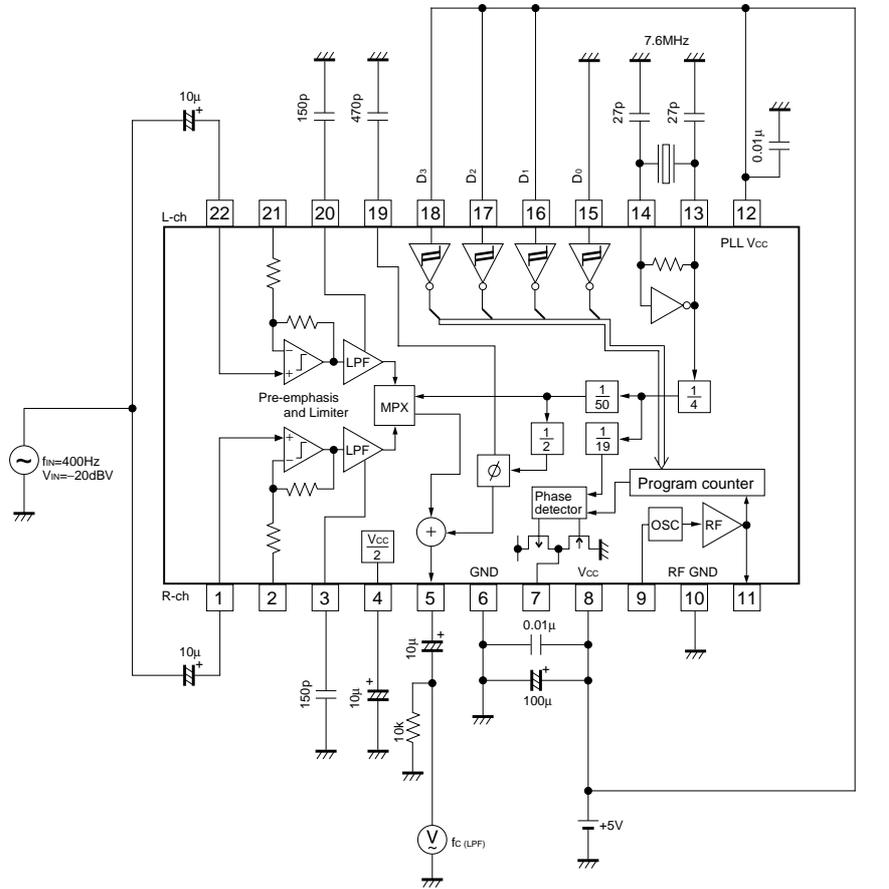


Fig.5

Transmission output level

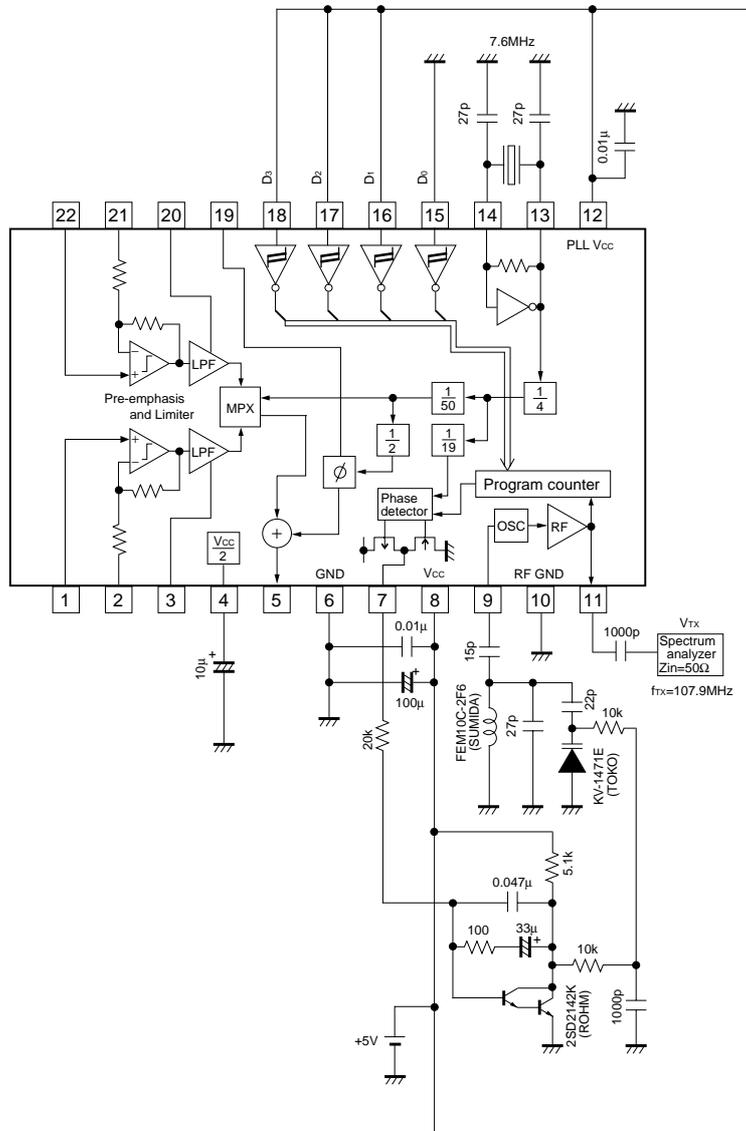


Fig.6

Multimedia ICs

“H” level input current
 “L” level input current

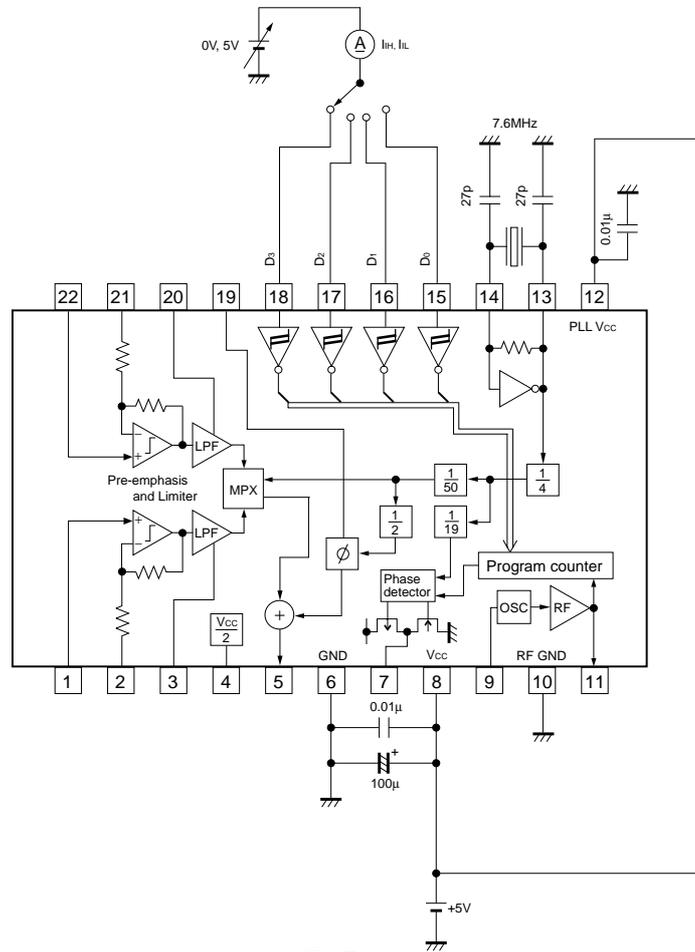


Fig.7

Multimedia ICs

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

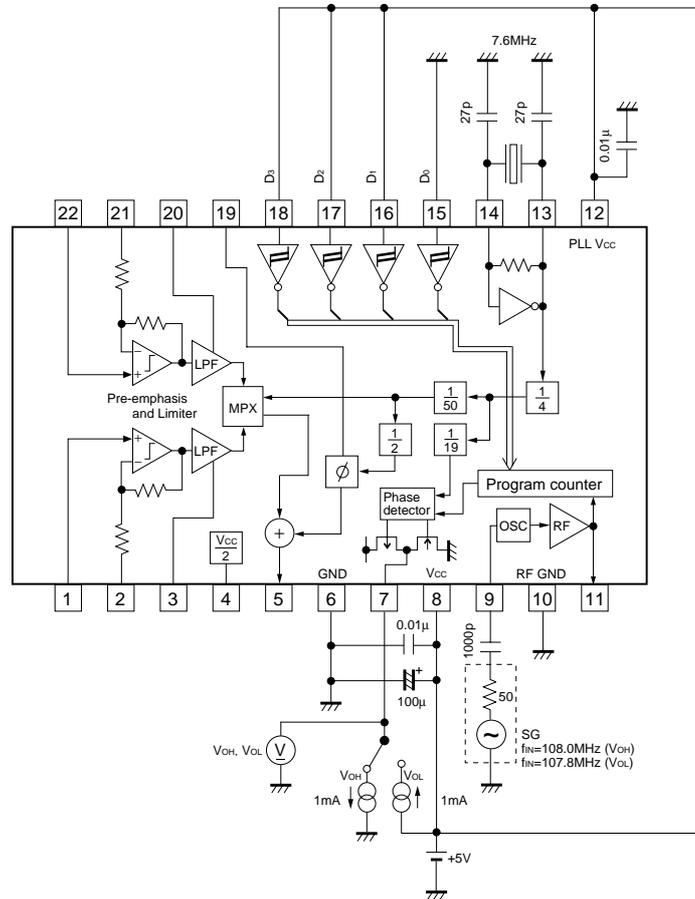


Fig.8

“off” level leak input current

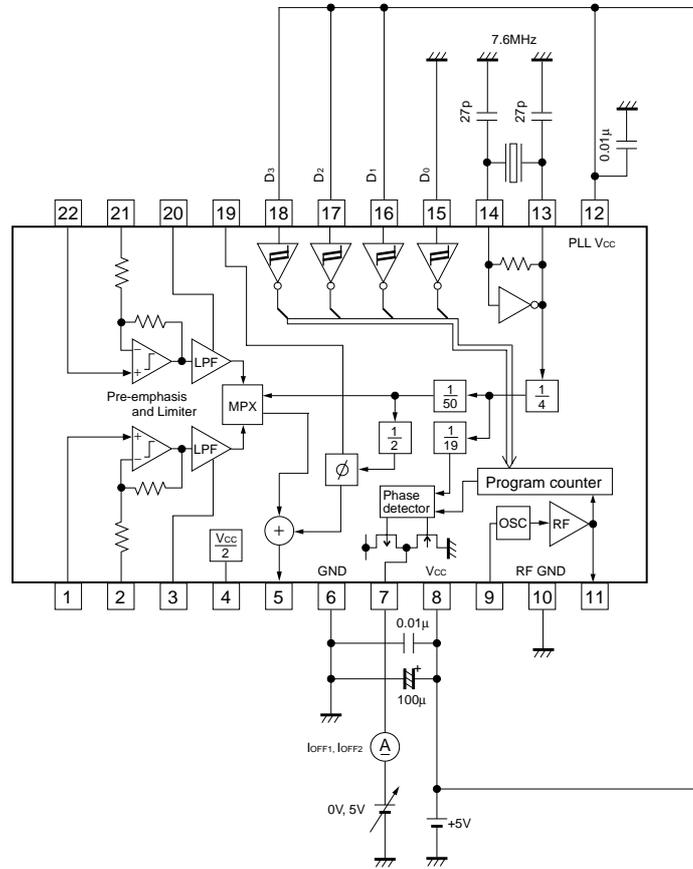


Fig.9

Multimedia ICs

●Application circuit

US BAND (88.0MHz~89.2MHz)

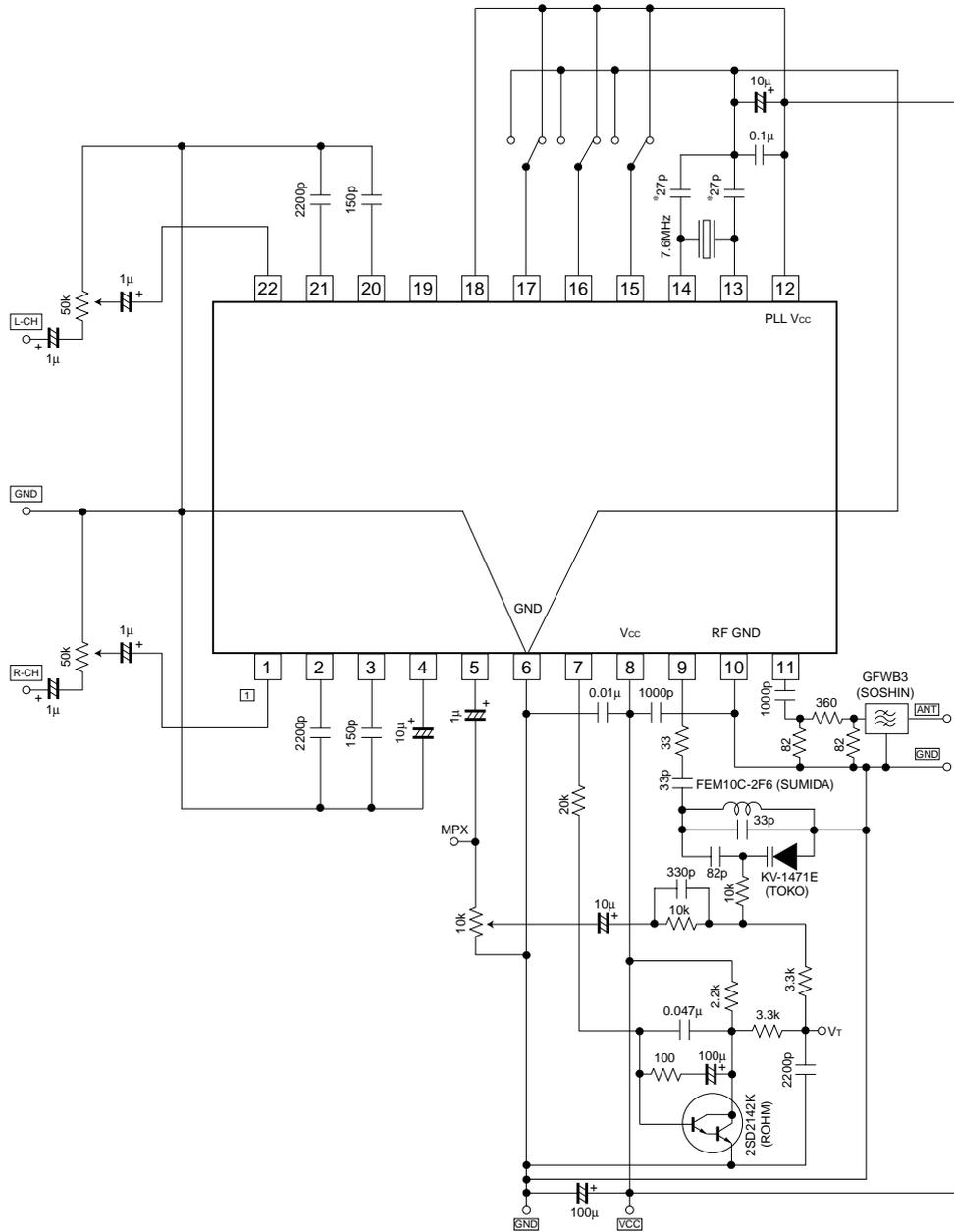


Fig.10

Multimedia ICs

●Circuit operation

Parallel data

Control data				Frequency
D ₀ (Pin15)	D ₁ (Pin16)	D ₂ (Pin17)	D ₃ (Pin18)	
L	L	L	L	87.7MHz
H	L	L	L	87.9MHz
L	H	L	L	88.1MHz
H	H	L	L	88.3MHz
L	L	H	L	88.5MHz
H	L	H	L	88.7MHz
L	H	H	L	88.9MHz
H	H	H	L	PLL stops. Phase comparator terminal supports high impedance.
L	L	L	H	106.7MHz
H	L	L	H	106.9MHz
L	H	L	H	107.1MHz
H	H	L	H	107.3MHz
L	L	H	H	107.5MHz
H	L	H	H	107.7MHz
L	H	H	H	107.9MHz
H	H	H	H	PLL stops. Phase comparator terminal supports high impedance.

●External dimensions (Units : mm)

