Wireless Audio Link IC

BH1414K

The BH1414K is a FM stereo transmitter IC that uses a simple configuration. This IC consists of a stereo modulator for generating stereo composite signals and a FM transmitter for broadcasting a FM signal on the air. A high S/N ratio and good timbre transmitter circuit can be composed with a few components. It is available for many applications due to the varieties of setting such as transmission output by serial data input.

●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 19kHz/38kHz low-pass trap filter circuit.
2) Built-in pilot-tone system FM stereo modulator circuit.
3) The transmission frequency is stable because it has a PLL system for the FM transmitter circuit.
4) PLL data input (CE, CK, DA) by serial input.
5) It is possible for input level setting, monaural operation and output ON/OFF control by serial input.
6) It is possible for the transmission output control.

●Absolute maximum ratings (Ta = 25°C)

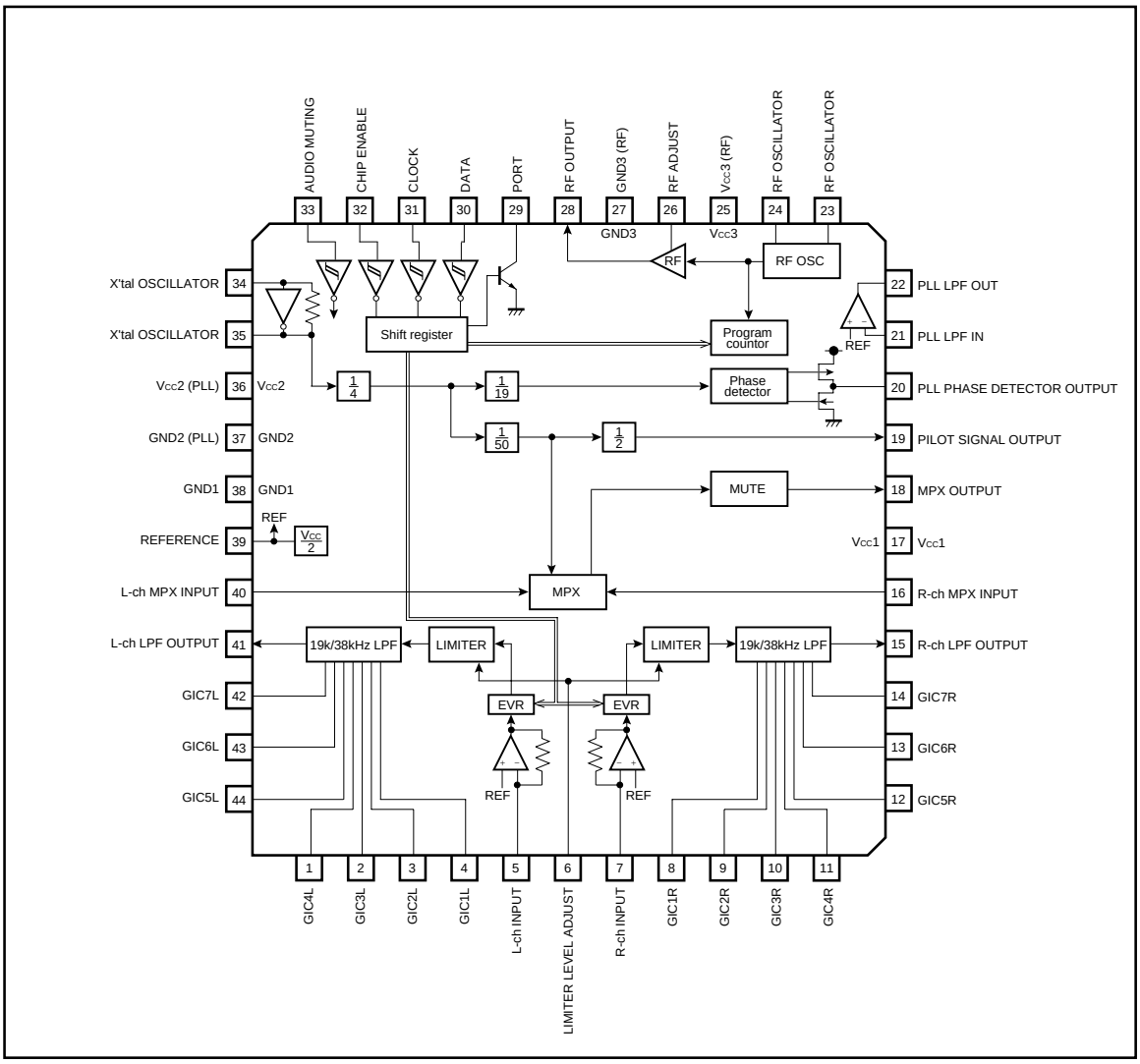
Parameter	Symbol	Limits	Unit
Supply voltage	V_{CC1}	+9.0	V
	V_{CC2}	+10.0	
Power dissipation	Pd	500	mW
Storage temperature range	Tstg	–55~+125	°C

∗ Reduced by 5mW for each increase in Ta of 1°C over 25°C.

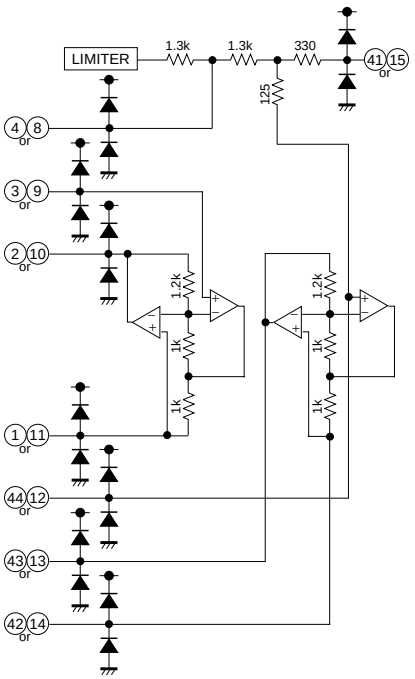
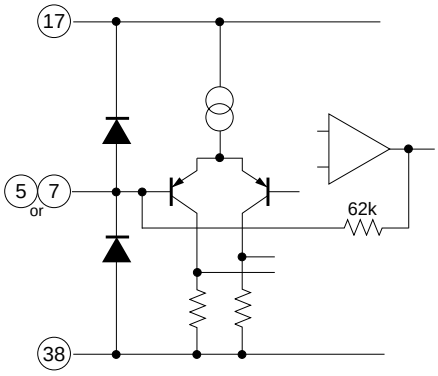
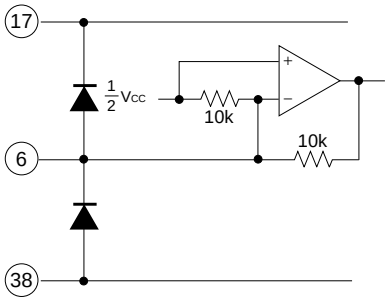
●Recommended operating conditions (Ta = 25°C)

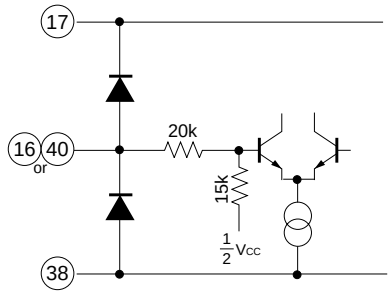
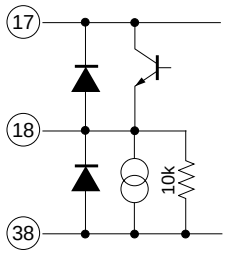
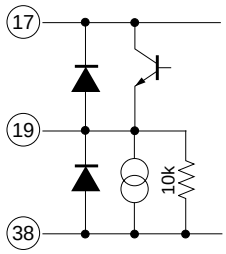
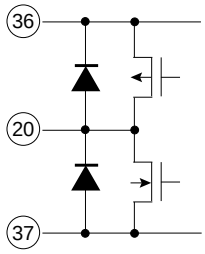
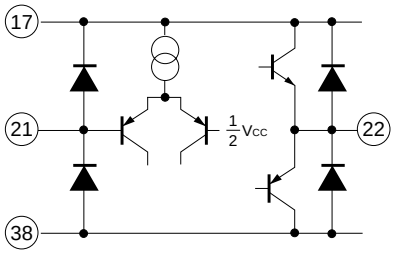
Parameter	Symbol	Min.	Typ.	Max.	Unit
Operating supply voltage	V_{CC}	4.5	–	5.5	V
Operating temperature range	Topr	–40	–	+85	°C
Audio input level	V_{IN-A}	–	–	500	mVrms
Audio input frequency	f_{IN-A}	20	–	15k	Hz
Transmission frequency	f_{TX}	75	–	110	MHz

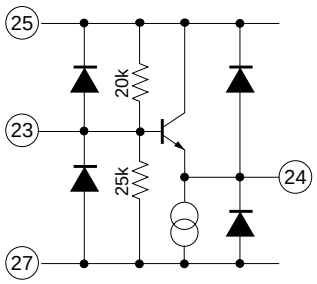
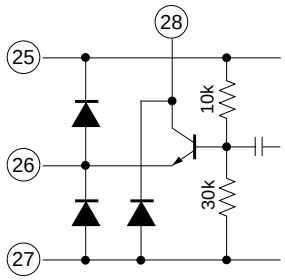
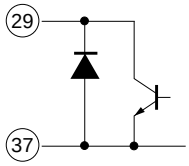
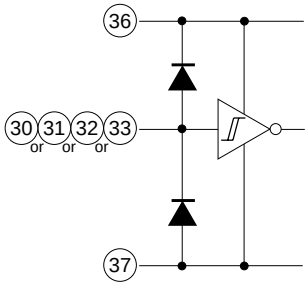
●**Block diagram**

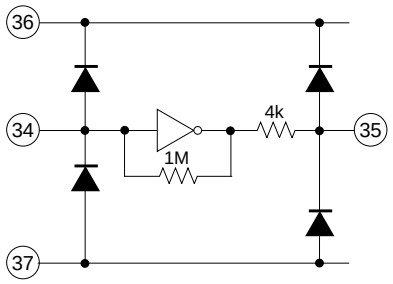
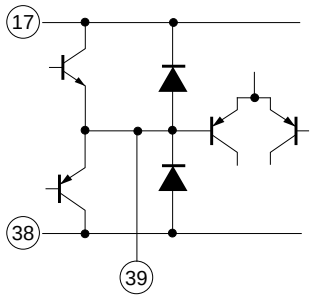


●Pin descriptions

Pin No.	Pin name	Equivalent circuit	Description	DC voltage (V)
1 2 3 4 42 43 44	L-ch LPF time constant terminal		It connects resistor and capacitor.	$\frac{1}{2}$ Vcc
8 9 10 11 12 13 14	R-ch LPF time constant terminal		It connects resistor and capacitor.	
15	R-ch LPF output and LPF time constant terminal			
41	L-ch LPF output and LPF time constant terminal			
5	L-ch audio source input terminal		It cuts DC with the capacitor and it inputs L-ch audio signal.	$\frac{1}{2}$ Vcc
7	R-ch audio source input terminal		It cuts DC with the capacitor and it inputs R-ch audio signal.	
6	Limiter level adjust terminal		It adjusts a limiter level by the resistance.	$\frac{1}{2}$ Vcc

Pin No.	Pin name	Equivalent circuit	Description	DC voltage (V)
16	R-ch MPX input terminal			1/2 Vcc
40	L-ch MPX input terminal			
17	Power supply 1 terminal	———		Vcc
18	MPX signal output terminal		It connects to the FM modulator.	1/2 Vcc –0.7
19	Pilot signal output terminal		It connects to the FM modulator.	1/2 Vcc –0.7
20	PLL phase detector output terminal		It connects to the PLL LPF circuit.	–
21	PLL LPF input terminal			–
22	PLL LPF output terminal			

Pin No.	Pin name	Equivalent circuit	Description	DC voltage (V)
23	RF oscillator terminal		This is the colpitts oscillator. It connects time constant of the oscillation.	$\frac{5}{9}$ Vcc
24				$\frac{5}{9}$ Vcc –0.7
25	Power supply 3 terminal (RF)	———		Vcc
26	RF adjust terminal		It connects resistor and capacitor.	$\frac{3}{4}$ Vcc –0.9
28	RF transmission output terminal		It connects LC.	Vcc
27	GND3 (RF)	———		GND
29	Port output terminal			–
30	Data input terminal		The input terminal of the serial data which is forwarded from the controller.	–
31	Clock input terminal		The clock which takes data and synchronization in serial data input.	
32	Chip enable terminal		The terminal to make high level in serial data input.	
33	Audio mute terminal		0.8Vcc2 ≤ Pin33 : Mute OFF 0.2Vcc2 ≥ Pin33 : Mute ON	

Pin No.	Pin name	Equivalent circuit	Description	DC voltage (V)
34 35	X'tal oscillator terminal		It connects a 7.6MHz crystal oscillator.	–
36	Power supply 2 terminal (PLL)	———		V_{CC}
37	GND2 (PLL)	———		GND
38	GND1	———		GND
39	Reference voltage terminal		It is a ripple filter for the reference voltage.	$\frac{1}{2}$ V_{CC}

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

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions	Meaasurement circuit
Quiescent current	I_Q	15	21	29	mA		Fig.1
Channel separation	Sep	30	45	–	dB	V_{IN}=125mVrms, L→R, R→L	Fig.2
Total harmonic distortion	THD	–	0.1	0.3	%	V_{IN}=125mVrms, L+R	Fig.3
Channel balance	C.B	–1.5	0	+1.5	dB	V_{IN}=125mVrms, L+R	Fig.2
Input output gain 1	G_{V1}	–4	–2	0	dB	V_{IN}=125mVrms, EVR=0dB, L+R	Fig.3
Input output gain 2	G_{V2}	+2	+4	+6	dB	V_{IN}=125mVrms, EVR=+6dB, L+R	Fig.3
Input output gain 3	G_{V3}	–10	–8	–6	dB	V_{IN}=125mVrms, EVR=–6dB, L+R	Fig.3
Limiter input level	$V_{IN(LIM)}$	205	260	325	mVrms	Output distortion at 3% for input level	Fig.4
LPF attenuation volume 1	$V_{O(LPF)1}$	–2	0.5	+1.5	dB	V_{IN}=125mVrms, f=10kHz	Fig.5
LPF attenuation volume 2	$V_{O(LPF)2}$	–	–37	–30	dB	V_{IN}=125mVrms, f=19kHz	Fig.5
LPF attenuation volume 3	$V_{O(LPF)3}$	–	–49	–35	dB	V_{IN}=125mVrms, f=38kHz	Fig.5
Signal to noise ratio	S/N	55	68	–	dB	V_{IN}=125mVrms, L+R	Fig.3
Sub carrier rejection ratio	SCR	–	–30	–20	dB	V_{IN}=125mVrms, L+R	Fig.3
Pilot output level	V_{OP}	180	200	220	mV_{P-P}	Pin19	Fig.3
Mute attenuation volume	$V_{O(MUTE)}$	–	–68	–60	dB	V_{IN}=125mVrms, L+R	Fig.6
Transmission output level	V_{TX}	84	87	90	dBμV	f_{TX}=100MHz	Fig.7
Transmission frequency precision	Δf_{TX}	–3	0	+3	kHz	f_{TX}=100MHz	Fig.7
"H" level input current	I_{IH}	–	–	1.0	μA	Pin30, 31, 32, 33 V_{IN}=5V	Fig.8
"L" level input current	I_{IL}	–1.0	–	–	μA	Pin30, 31, 32, 33 V_{IN}=0V	Fig.8
"H" level output voltage	V_{OH}	V_{CC}–1.0	V_{CC}–0.3	–	V	Pin20 I_{OUT}=–1.0mA	Fig.8
"L" level output voltage	V_{OL}	–	0.3	1.0	V	Pin20 I_{OUT}=1.0mA	Fig.8
"OFF" level leak current 1	I_{OFF1}	–	–	100	nA	Pin20 V_{OUT}=5V	Fig.9
"OFF" level leak current 2	I_{OFF2}	–100	–	–	nA	Pin20 V_{OUT}=GND	Fig.9
"L" level output voltage	V_{OL}	–	0.2	1.0	V	Pin29 I_{OUT}=3.0mA	Fig.8
"OFF" level leak current	I_{OFF}	–	–	1.0	μA	Pin29 V_{OUT}=5V	Fig.9

◎ This product is not designed for protection against radioactive rays.
◎ The specification of transmission output level be based on the Radio Law in every country and the area.

●Measuring circuits

Quiescent current

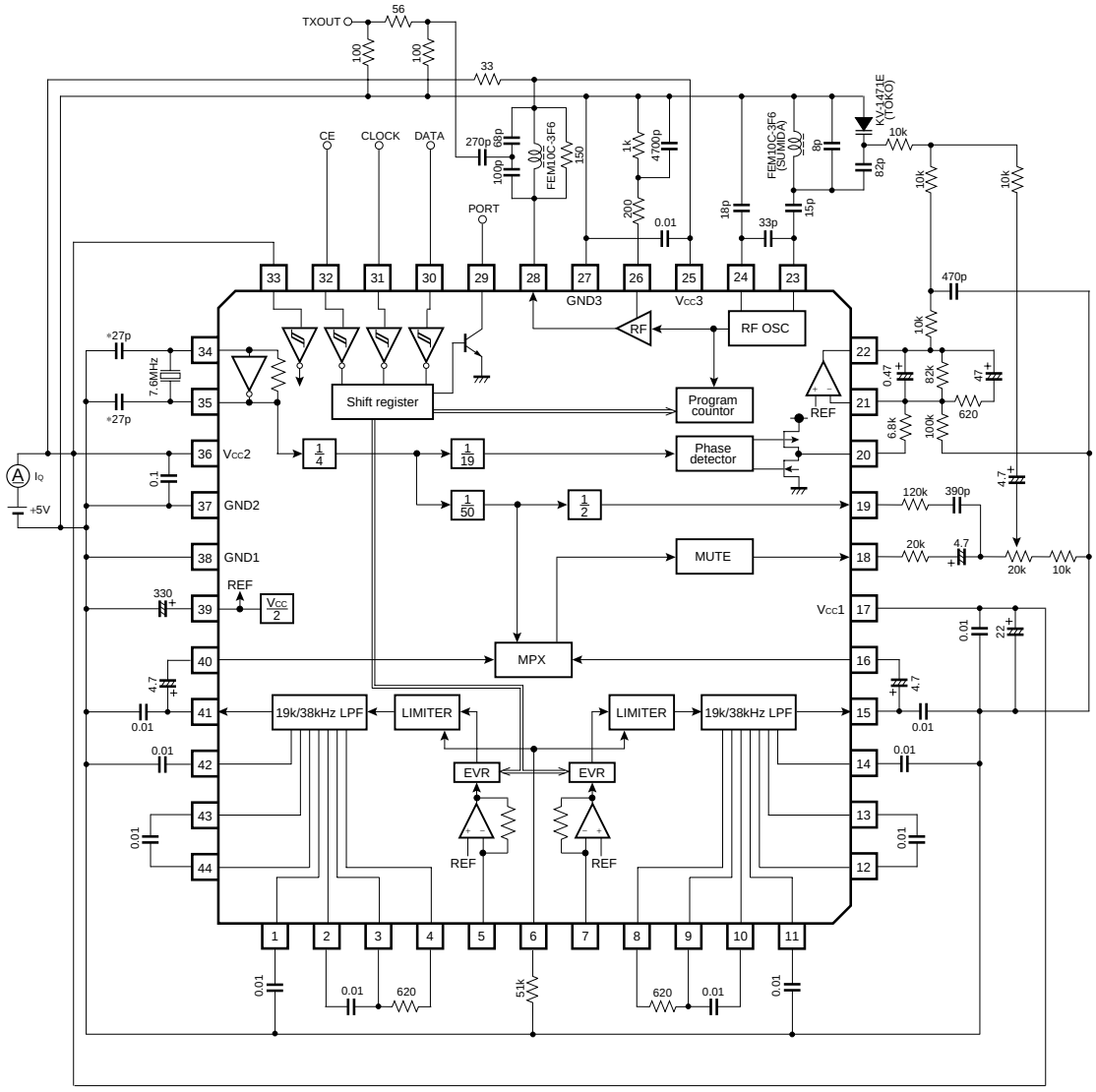


Fig.1

∗The constant of the capacitor must be determined by the agreement with a crystal maker.

Channel separation
Channel balance

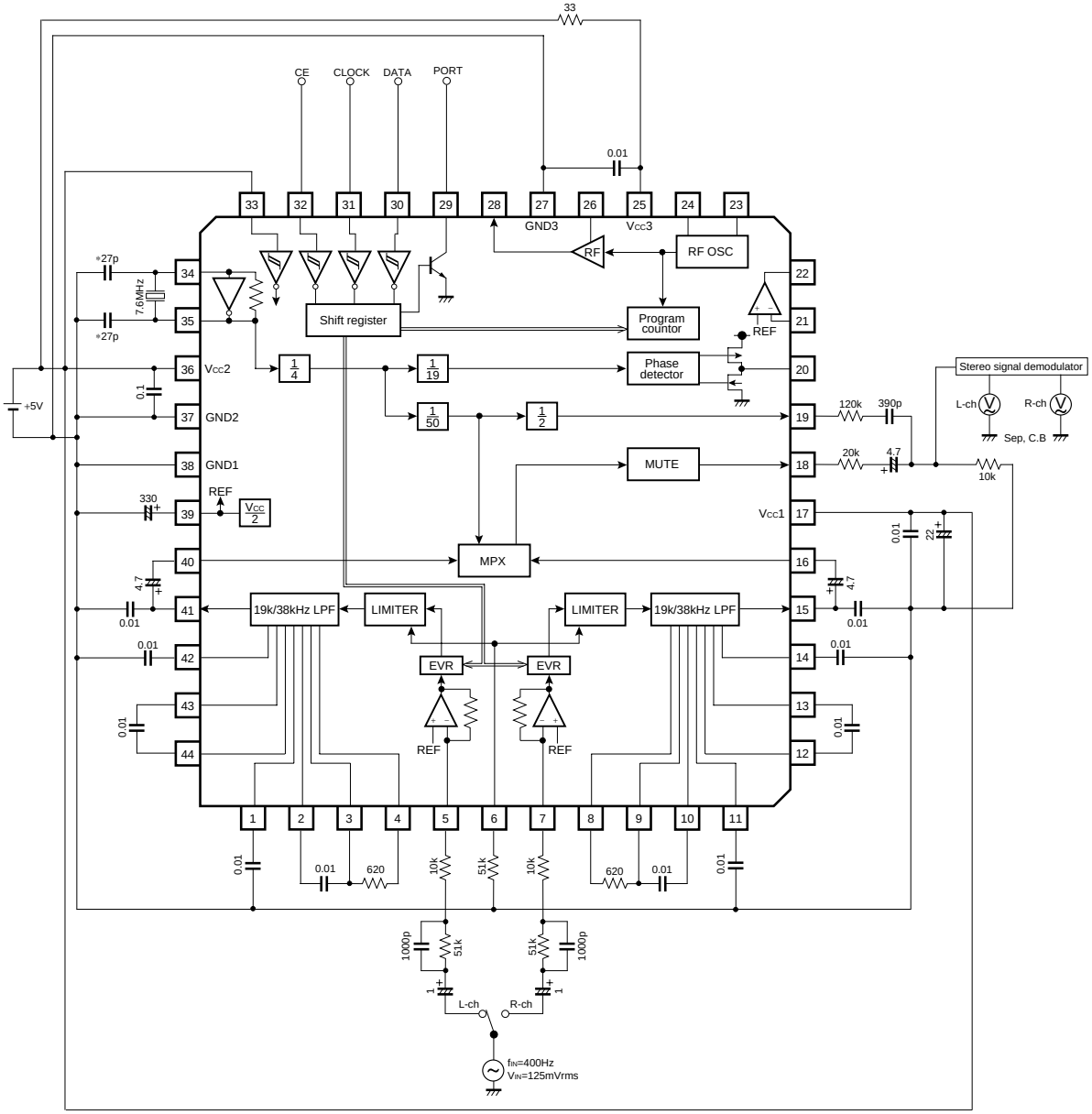


Fig.2

∗The constant of the capacitor must be determined by the agreement with a crystal maker.

Total harmonic distortion
Input output gain
Signal to noise ratio
Sub carrier rejection ratio
Pilot output level

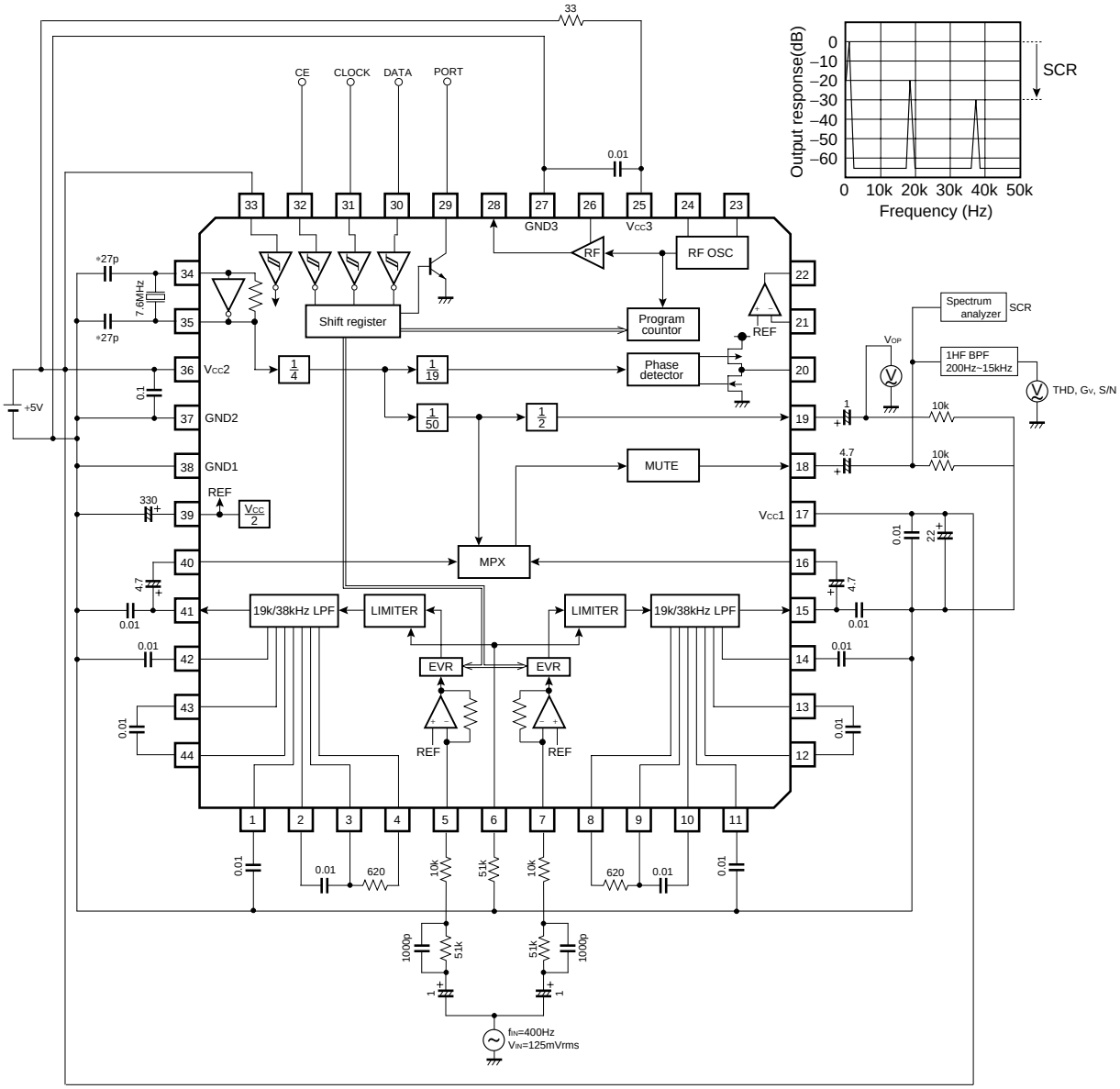


Fig.3

*The constant of the capacitor must be determined by the agreement with a crystal maker.

Limiter input level

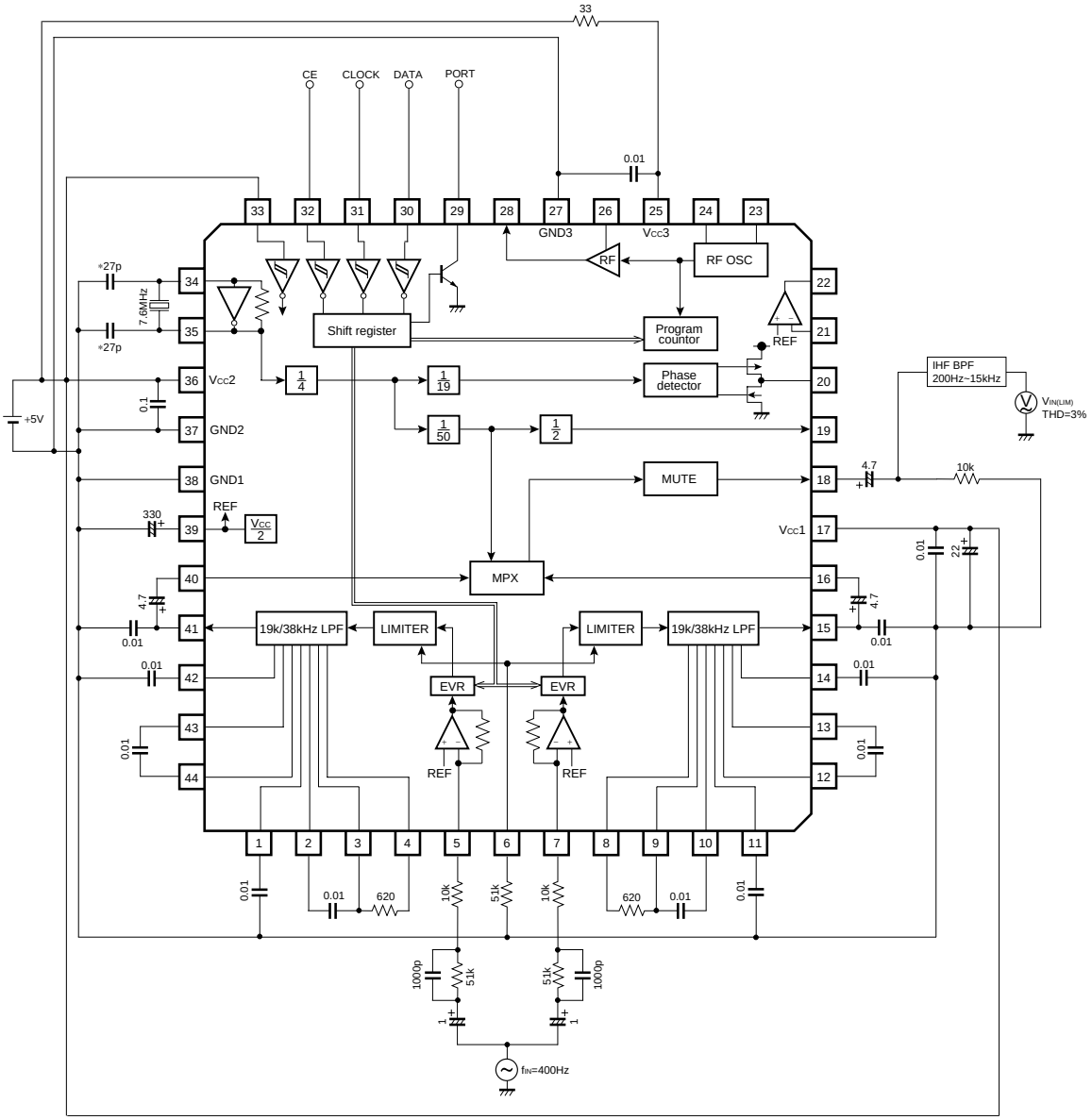


Fig.4

*The constant of the capacitor must be determined by the agreement with a crystal maker.

LPF attenuation volume

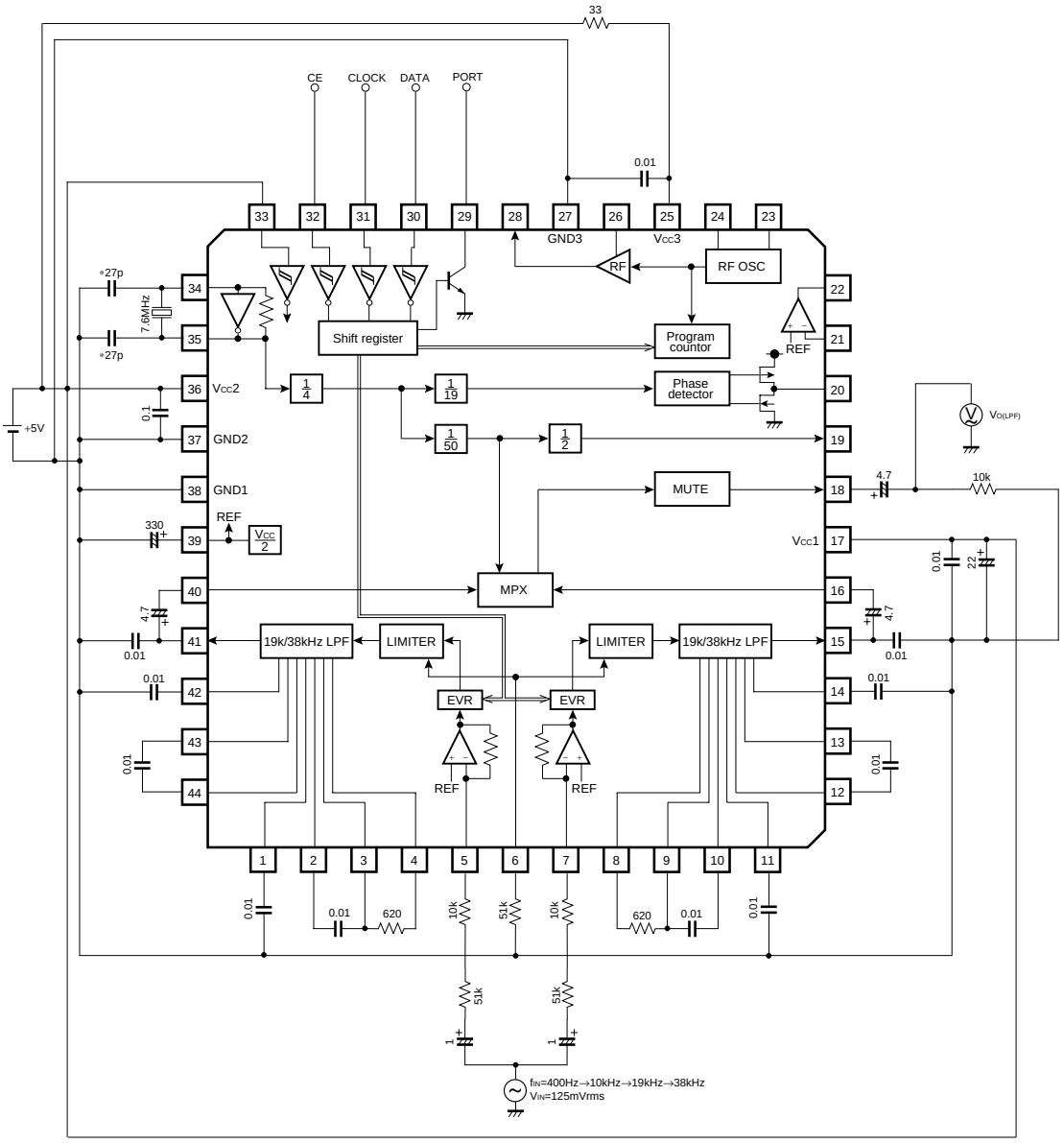


Fig.5

∗The constant of the capacitor must be determined by the agreement with a crystal maker.

Mute attenuation volume

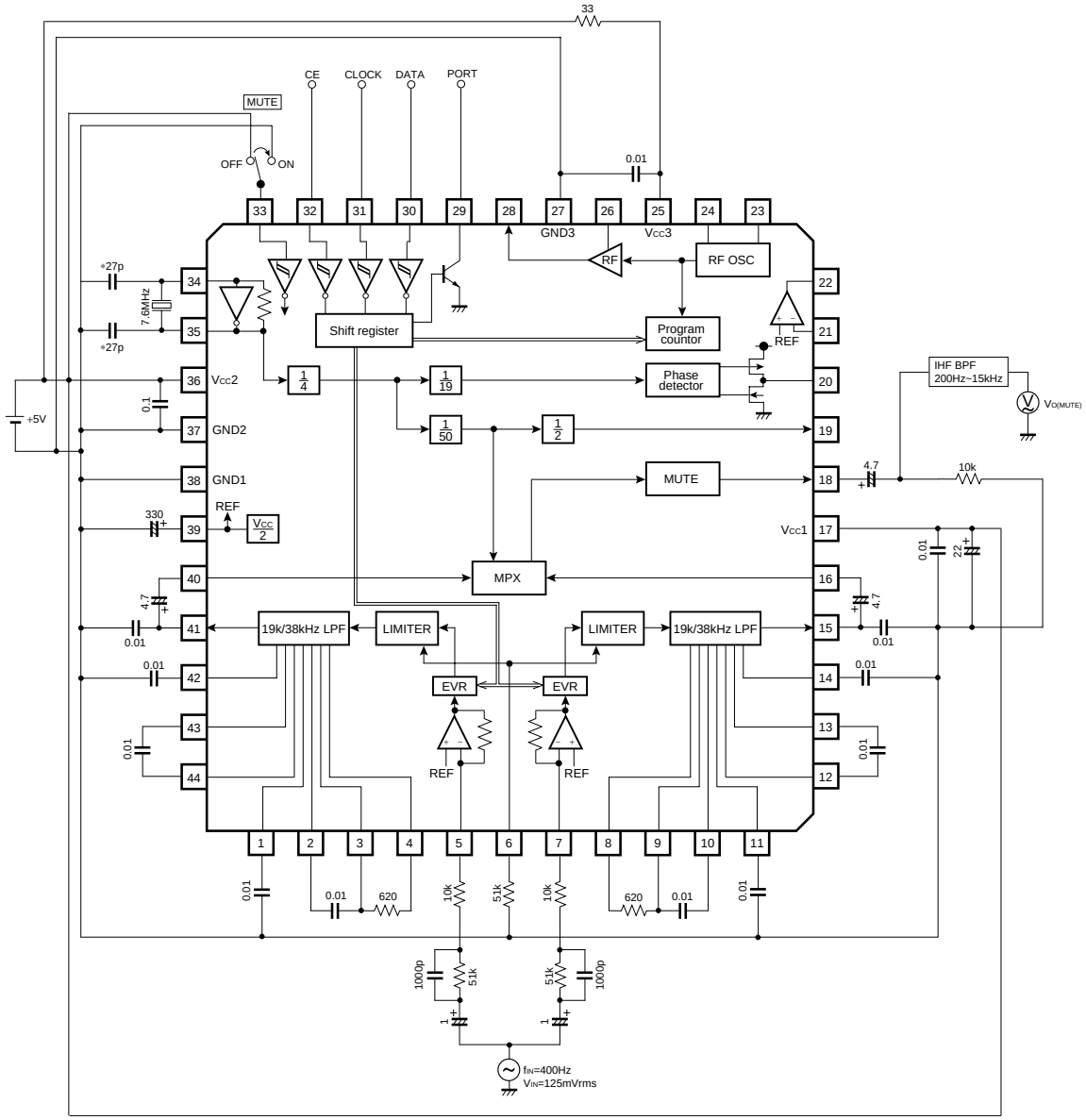


Fig.6

*The constant of the capacitor must be determined by the agreement with a crystal maker.

Transmission output level
Transmission frequency precision

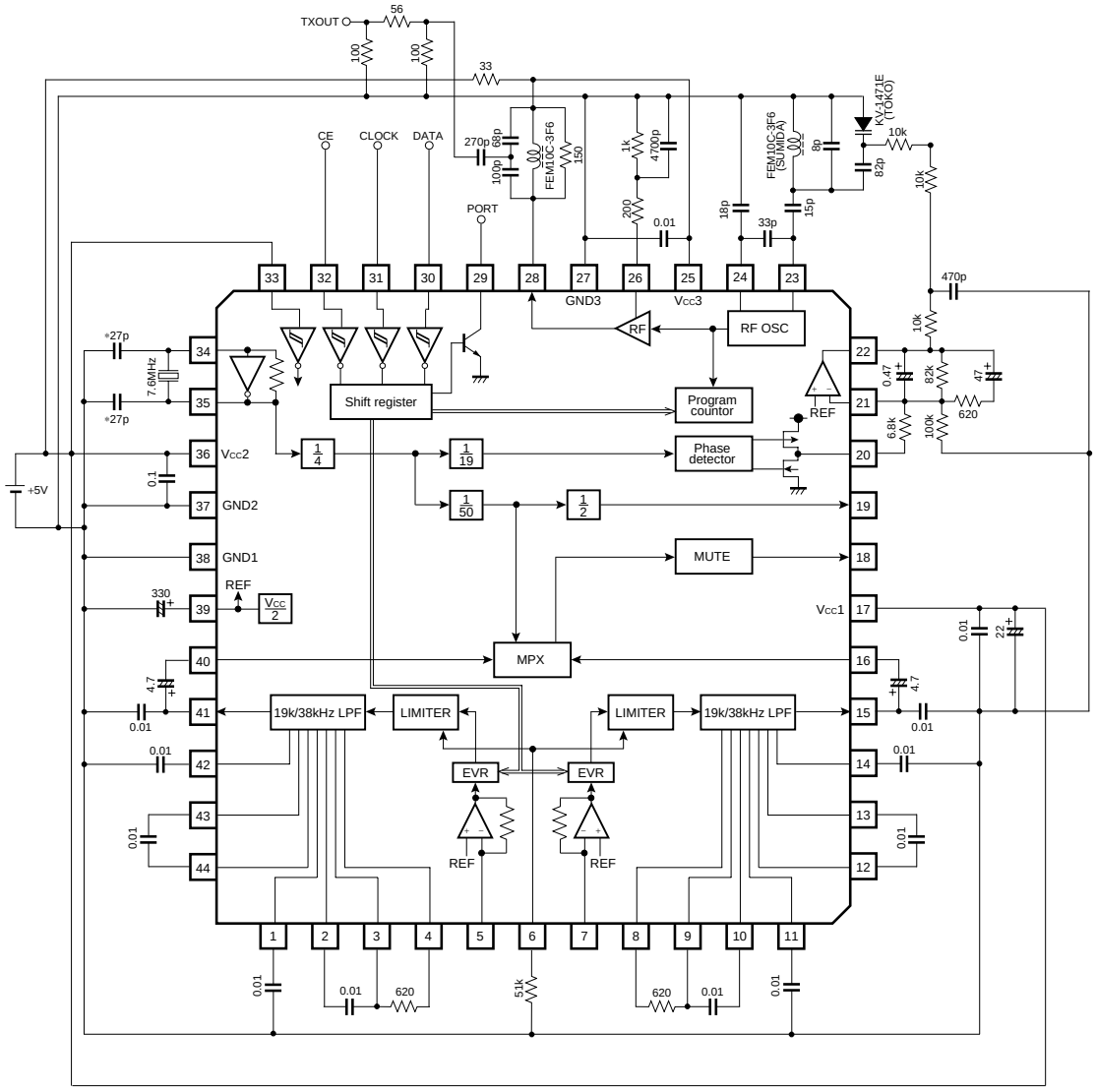


Fig.7

*The constant of the capacitor must be determined by the agreement with a crystal maker.

“H” level input current
“L” level input current
“H” level output voltage
“L” level output voltage

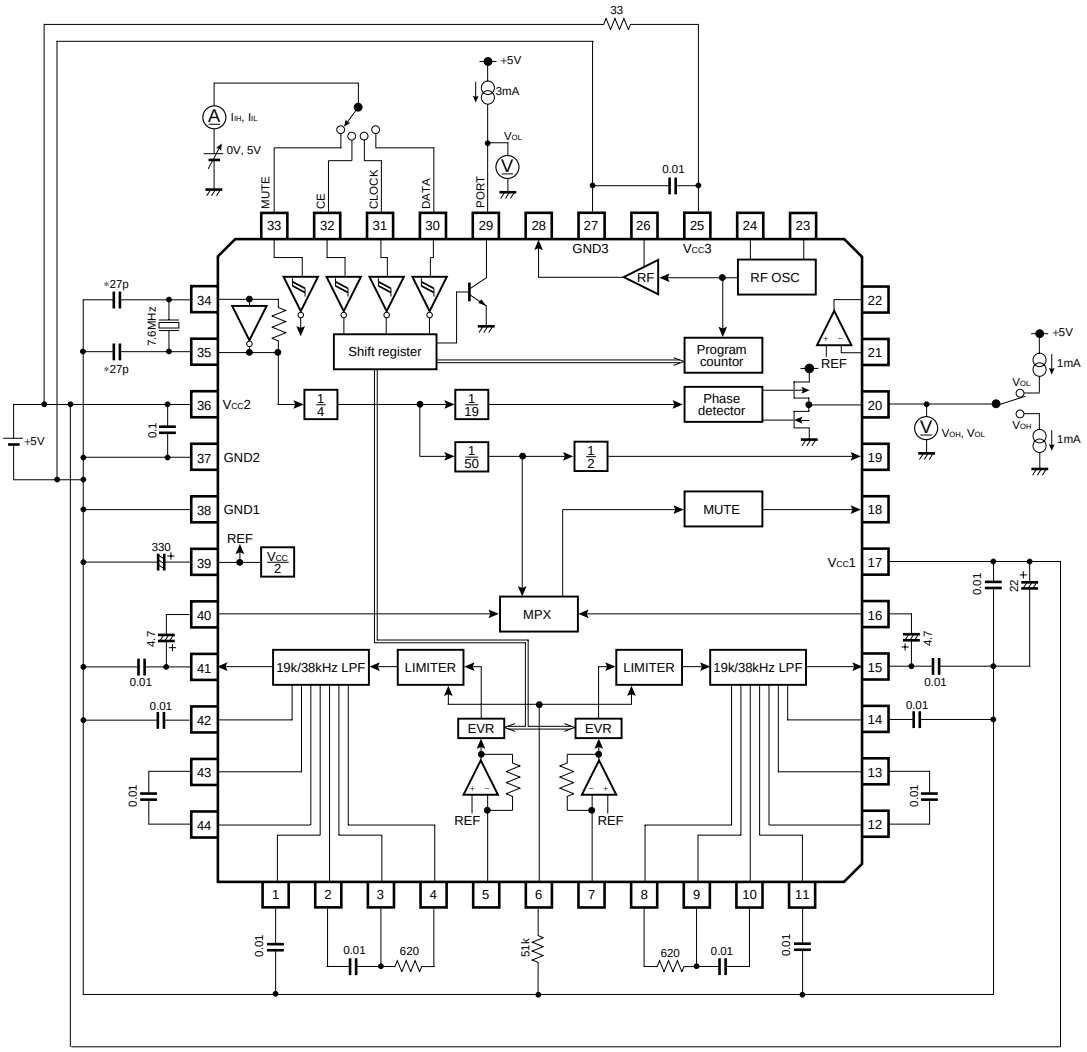


Fig.8

∗The constant of the capacitor must be determined by the agreement with a crystal maker.

"OFF" level leak current

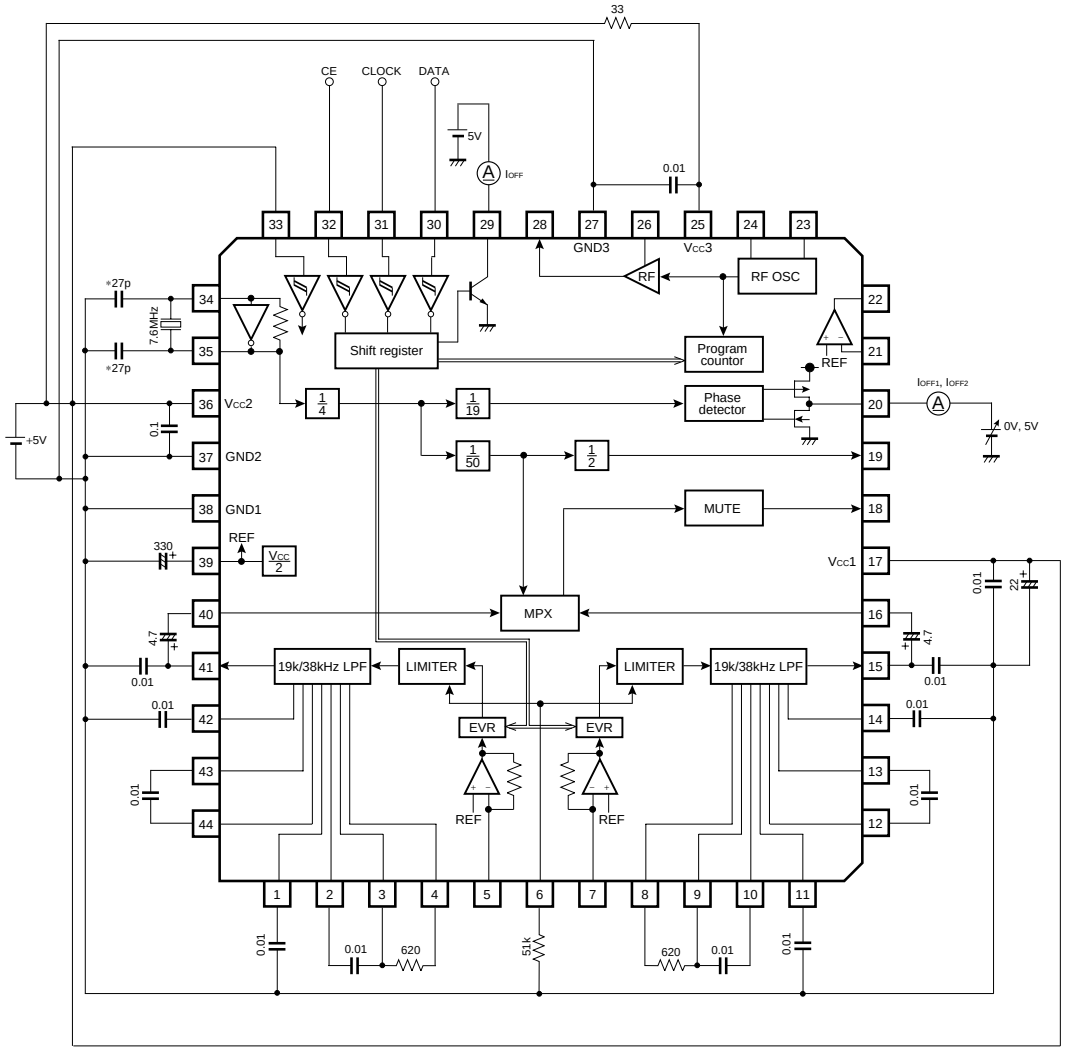


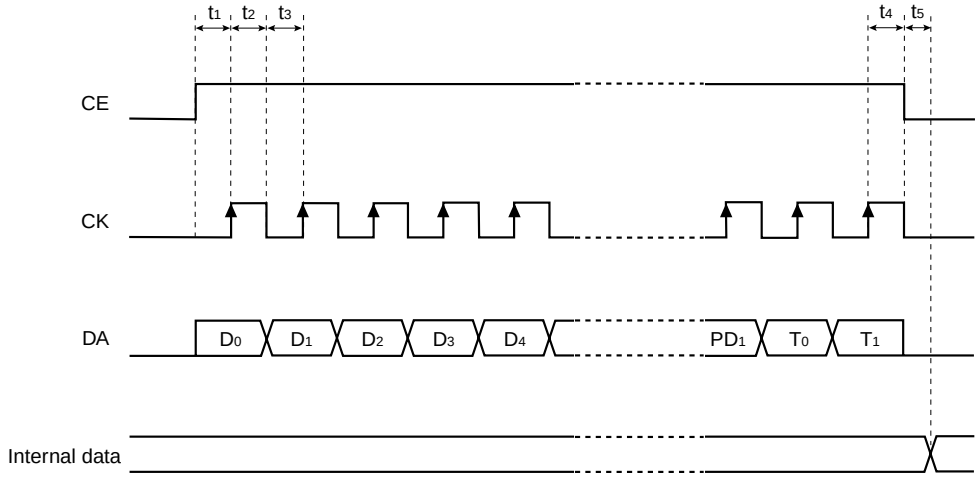
Fig.9

*The constant of the capacitor must be determined by the agreement with a crystal maker.

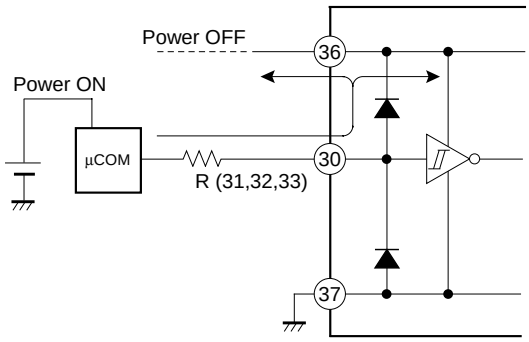
●Circuit operations

(1) Input of the serial data

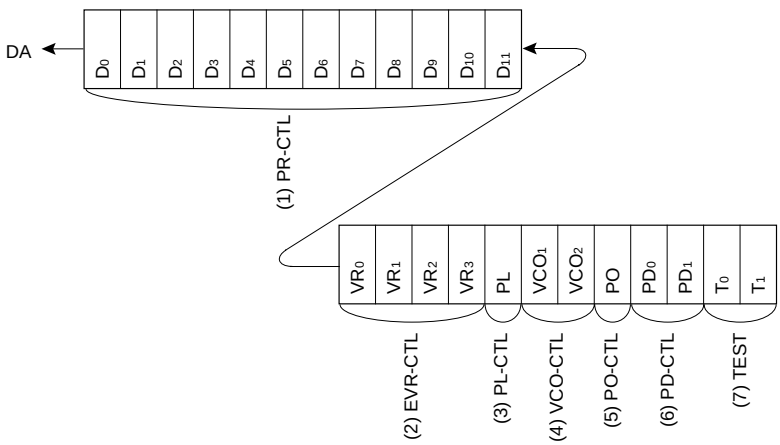
$t_1, t_2, t_3, t_4 \geq 1.5\mu sec$
$t_5 < 1.5\mu sec$ (X'tal : 7.6MHz)



When the serial data input terminal (Pin 30, Pin 31, Pin 32) and the mute control terminal (Pin 33) connect with the μ-com, in off the power of BH1414K and on the power of μ-com, because the current flows backward from the μ-com to BH1414K, insert limitation resistance between the serial data input terminal and the data output terminal of μ-com. But, when the data output by μ-com doesn't always maintain at the "H" voltage, that matter may be left out of consideration.



(2) Composition of the serial data



(3) Explanation of the serial data

<table>
<tr><th>No.</th><th>Control unit</th><th>Contents</th></tr>
<tr><td>(1)</td><td>PROGRAM COUNTER

D_0~D_{11}</td><td>· 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_{11} 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><td colspan="4">5</td><td colspan="4">E</td><td colspan="4">3</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td></tr>
<tr><td>D_0</td><td>D_1</td><td>D_2</td><td>D_3</td><td>D_4</td><td>D_5</td><td>D_6</td><td>D_7</td><td>D_8</td><td>D_9</td><td>D_{10}</td><td>D_{11}</td></tr>
<tr><td colspan="6">LSB</td><td colspan="6">MSB</td></tr>
</table>
</td></tr>
<tr><td>(2)</td><td>EVR

VR_0~VR_3</td><td>· It controls EVR. L-ch and R-ch are set at the same time.
<table>
<tr><th>VR_0</th><th>VR_1</th><th>VR_2</th><th>VR_3</th><th>EVR GAIN</th></tr>
<tr><td>0</td><td>1</td><td>1</td><td>1</td><td>–6</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>0</td><td>–6</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>1</td><td>–5</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>0</td><td>–4</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>1</td><td>–3</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>0</td><td>–2</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>1</td><td>–1</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>1</td><td>+1</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>0</td><td>+2</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>1</td><td>+3</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>0</td><td>+4</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>1</td><td>+5</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>0</td><td>+6</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>1</td><td>+6</td></tr>
</table>
</td></tr>
<tr><td>(3)</td><td>MULTIPLEXER

PL</td><td>· It changes a stereo and monaural operation.
<table>
<tr><th>PL</th><th colspan="2">Condition of the composite signal</th></tr>
<tr><td>0</td><td>Stereo operation</td><td>$L+R+(L-R)\sin\omega_s t+P\sin\frac{\omega_s}{2}t$</td></tr>
<tr><td>1</td><td>Monaural operation</td><td>L+R, Pilot OFF</td></tr>
</table>
</td></tr>
<tr><td>(4)</td><td>VCO

VCO_1, VCO_2</td><td>· It controls the VCO operation.
<table>
<tr><th>VCO_1</th><th>VCO_2</th><th>VCO</th></tr>
<tr><td>0</td><td>0 or 1</td><td>Enable</td></tr>
<tr><td>1</td><td>0 or 1</td><td>Disable</td></tr>
</table>
</td></tr>
<tr><td>(5)</td><td>PORT(Pin29)

PO</td><td>· It controls open collector output.
<table>
<tr><th>PO</th><th>Open collector output</th></tr>
<tr><td>0</td><td>High impedance</td></tr>
<tr><td>1</td><td>Low (ON)</td></tr>
</table>
</td></tr>
<tr><td>(6)</td><td>PHASE DETECTOR

PD_0, PD_1</td><td>· It controls change 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>(7)</td><td>TEST MODE

T_0, T_1</td><td>· It is data for the LSI test.
· Always Input "00".</td></tr>
</table>

●**Application example**

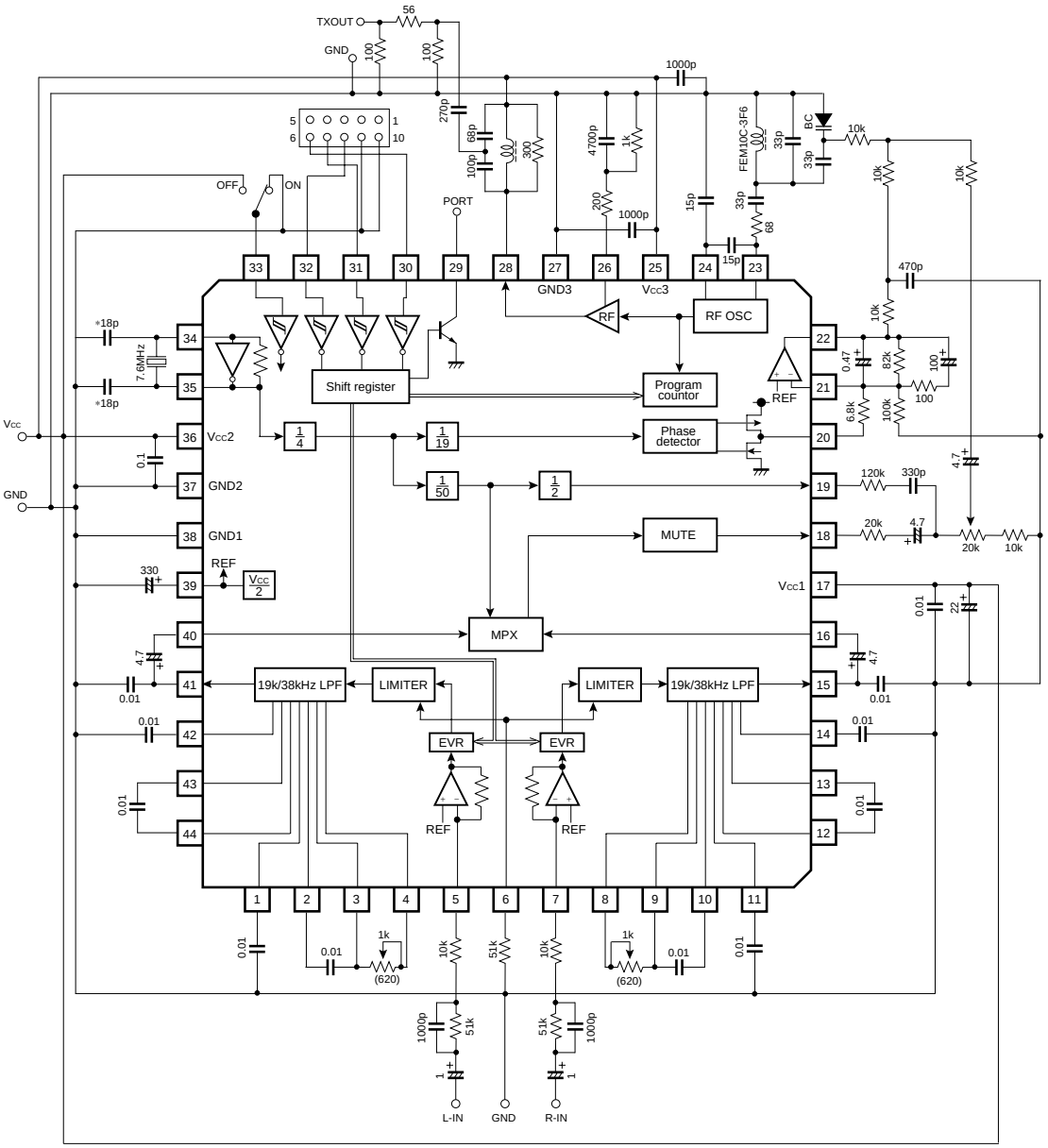
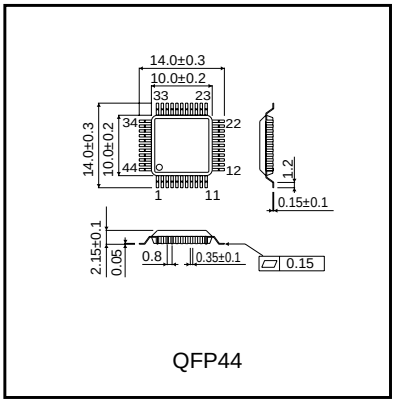


Fig.10

*The constant of the capacitor must be determined by the agreement with a crystal maker.

●**External dimensions** (Units : mm)



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