Preliminary

SANYO

05.02.21 Ver2.2

LV24000LP/T

LV24002LP

Development Specifications

Ultra-compact FM tuner IC for mobile set

Overview

The LV24000/02 is FM tuner IC's that requires absolutely no external components.

They incorporates not only the FM tuner functions but master volume control, tone control, buzzer, source selector, Head phone amp and other functions as well in a compact VQLP package with dimensions of only 5 x 5 x 0.8mm.

These IC's are simply ideal for incorporating FM tuner functions into mobile phones and other small mobile set where space is always at a premium.

Functions

LV24000

FM FE / FM IF / MPX Stereo Decoder / Tuning / Volume control / Tone control / Buzzer

LV24002

LV24000 function + Source selector + Head phone amp

Features

- No external components
- No alignments necessary
- Fully integrated low IF selectivity and demodulation
- Built in adjacent channel interference total reduction (no 114kHz, no 190kHz)
- Due to new tuning concept, the tuning is independent of the channel spacing
- Very high sensitivity due to integrated low noise RF input amplifier
- Very low power Standby mode. No power switch circuitry required
- MPX output for RDS application
- 3-wire bus interface (Date, Clock, NR-W)
- Digital AFC - Tuner locks to frequency after tuning sequence
- 8 level programmable Soft Mute
- 8 level programmable Stereo Blend

- In combination with the host, fast, low power operation of preset mode, manual search, automatic search and automatic preset store are possible
- Covers all Japanese, European and US bands

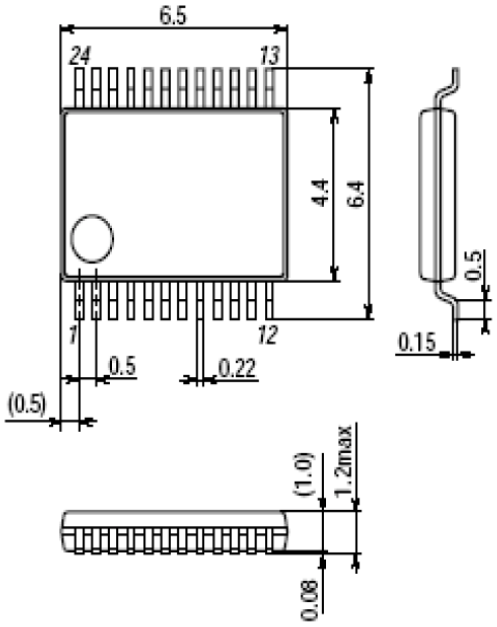
Package dimension

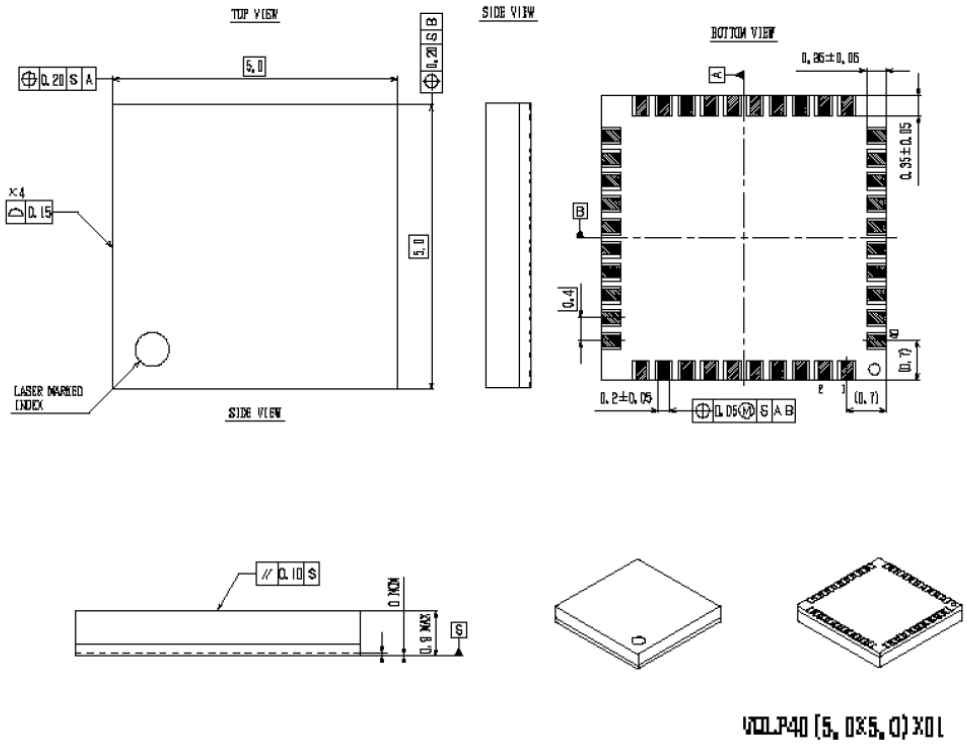
LV24000/02LP VQLP40 (5 x 5 x 0.8 mm)

LV24000T TSSOP24 (9.75 x 5.8 x 1.0mm)

(Notes) Only TSSOP package need two external OSC inductor parts

IC Package Dimension





VQLP40 (5.0X5.0) X01

Specifications

Maximum Ratings at Ta =25°C

PARAMETER	SYMBOL	CONDITIONS	RATINGS	UNIT
Maximum Supply Voltage	VCC max	Analog Supply Voltage	6.0	V
	VDD max	Digital Supply Voltage	5.0	V
Digital Input Voltage	Vin1 max	Clock,Data,NR_W	Vdd+0.3	mA
	Vin2 max	External_clk_in	Vdd+0.3	V
Allowable Power Dissipation	Pd max	LV24000LP/T	140	mW
		LV24002LP:Ta□70□ *note 40*0.8mm garaeposhi board ＊LV24002 has Head_Phone_AMP	450	mW
Storage Temperature	Tstg		-40 ～ +125	C
Operating Temperature	Topr		-20 ～ +70	C

Operating Conditions at Ta = 25°C V_{CC} = V_{DD}

PARAMETER	SYMBOL	CONDITIONS	RATINGS	UNIT
Recommended Supply Voltage	VCC	Analog Block	3.0	V
	VDD	Digital Block	3.0	V
Operating Supply Voltage Range	VCC op		2.7 ～ 5.0	V
	VDD op		2.5 ～ 4.0	V
	VIO op	Interface Supply Voltage	1.8 ～ 4.0	V

Note:Power supply voltage VIO eqaual VDD,or Vio < Vdd (Vio□Vdd)

Interface Conditions at Ta = from -20°C to +70°C,Vss=0V

PARAMETER	SYMBOL	CONDITIONS	Min	Typ	Max	Unit
Supply Voltage	V_{DD}		2.5	--	4.0	V
Digital part input	VIH	High level input voltage range	0.7VDD	--	VDD	V
	VIL	Low level input voltage range	0	--	0.6	V
Digital part Output	I OL	Low level output current	2.0	--	--	mA
	VOL	Low level output voltage IOL=2mA	--	--	0.6	V
Clock input Frequency	fclk	3wire_bus (29pin)Clock Frequency	--	--	0.7	MHz
External clock Frequency	f_{clk_ext}	CLK_IN (31Pin)Frequency	32K	--	14M	Hz

Note: CLK_IN (31pin)can input sign wave.*Extternl clock deviation is need 250ppm.

Operating Characteristics at Ta = 25°C, Vcc=3.0V , Vdd=3.0V , Vol=14, Soft Mute / Stereo=off

Vol=14 –Block2 register09h Volume_Bit 3-0 = 0010B

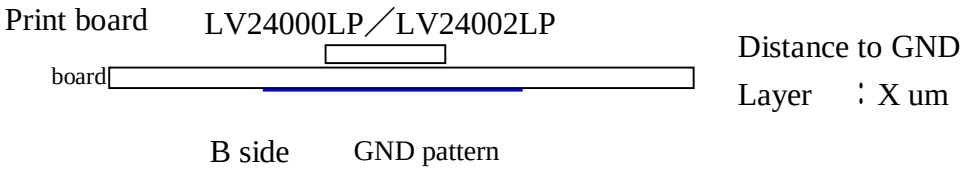
PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Operational Supply Current	ICCA	Analog Block at 60dBu input The 23pin is measured *except LV24002 HP AMP current LV24000 LV24002	15	19	24	mA
	ICCD	Digital Block at 60dBu input The 27,40 pin are measured.	0.2	0.4	0.8	
Standby supply Current	ICCA	Analog standby mode The 23 pin is measured.	--	3	30	uA
	ICCD	Digital standby mode The 27,40 pins are measured.	--	3	30	
FM Coverd frq	F_range	See Appendix	76	--	108	MHz

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
[FM Receiving characteristics ;MONO] :fc=80MHz,fm=1kHz,22.5kHzdev. soft_stereo,soft_mute,Buss,Treble are all OFF.						
Input limiting voltage	-3dB LS	Vin=60dBμ standard for a -3dB input	--	13	19	dBμV EMF
Practical sensitivity	QS1	for 30dB signal to noise ratio input Deemphasis is 75 μsec SG open	--	10	17	dBμV EMF
Practical sensitivity	QS2	for 26dB signal to noise ratio input Deemphasis is 75 μsec SG close	--	1.25	--	μV
Demodulator Output level	Vo	Vin=60dBu, 11pin output level	60	100	140	mV
Channel balance	CB	Vin=60dBu, ratio of 11pin to 12pin output level	-2	0	2	dB
Signal to noise ratio	S/N	Vin=60dBu, 11pin output level	48	58	--	dB
Total harmonic distortion 1(MONO)	THD1	Vin=60dBu, 22.5KHzdev,11pin output	--	0.4	1.5	%
Total harmonic distortion 2(MONO)	THD2	Vin=60dBu, 75KHzdev,11pin output	--	1.3	3.0	%
Field strength level	FS	Input lever for FS1 to FS2	8	18	27	dBu
Muting attenation	Mute-Att	Vin=60dBu, 11pin output level	60	70	--	dB
[FM Receiving characteristics ;STEREO] :fc=80MHz,fm=1kHz,Vin=60dBμV,L+R=30%(22.5KHzdev),Pilot=10%(7.5Khzdev)						
Separation	SEP	L-mod,11pin→12pin output level	20	35	--	dB
Total harmonic distortion (STEREO)	THD-ST	Main-mod(L+R), 11pin/12pin output,IHF_BPF	--	0.6	1.8	%

[Head phone power characteristics ;LV24002] :Ta = 25°C VCC=3.0V,VDD=3.0V, fc=1KHz, RL=16Ω, Vol= 20(Max) Line input						
HP AMP Operation Supply Current	ICC_HPA1	Line input mode. no input	--	3	6	mA
HP AMP Standby supply Current	ICC_HPA2	Head_phone power off mode the 10 pin is measured.	--	3	40	μA
HPA power	Po_HPA	THD = 10% VR= MAX	3	--	--	mW
Total harmonic distortion	THD-HPA	Po=1mW	--	3	5	%
Output noise voltage	Vno	Rg=10KΩ、BPF=200Hz～15KHz,VR=14	--	0.03	0.3	mV

* VR=Max : Block2 register 09h Volume_Bit3-0 = 0000B setting and Block2 register 07h Volume sgift,bit6= 1 setting

LV24000LP／LV24002LP PCB condition



● This IC Package is printed inductor backside of the package for local oscillation. It is necessary to set the distance from back side of the IC package to PCB GND pattern at least Xum=400um for covering received Frequency range 76MHz-108MHz.

● This IC is measured under this condition(400um) for received frequency range.

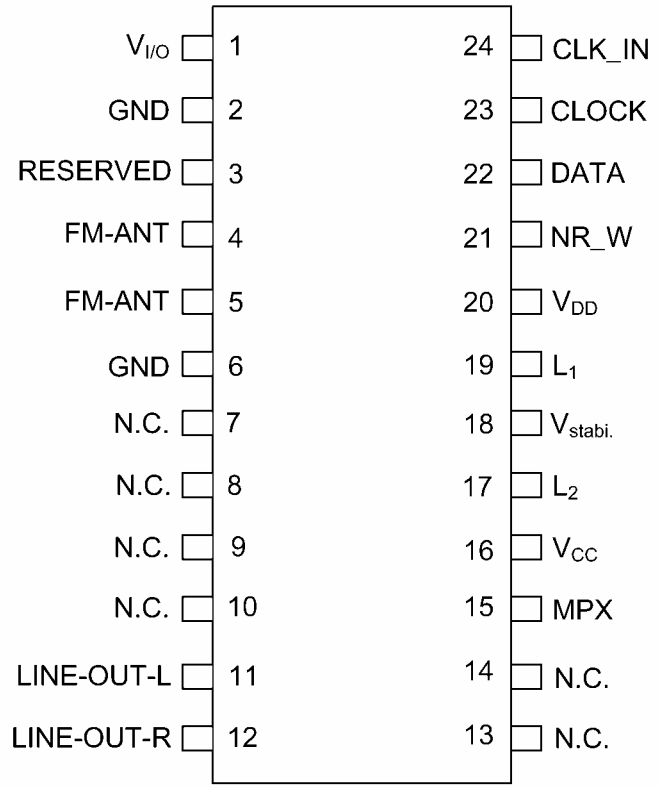
● If you can not use this IC under this condition,you can adjust received frequency next method.(for example)

1.shift the received frequency higher side
For putting inductor between L2(24 pin) and V_stabi_out(25pin) in addition between L1(26pin) and V_stabi_out(25pin) ,you can shift the received frequency hiher side.

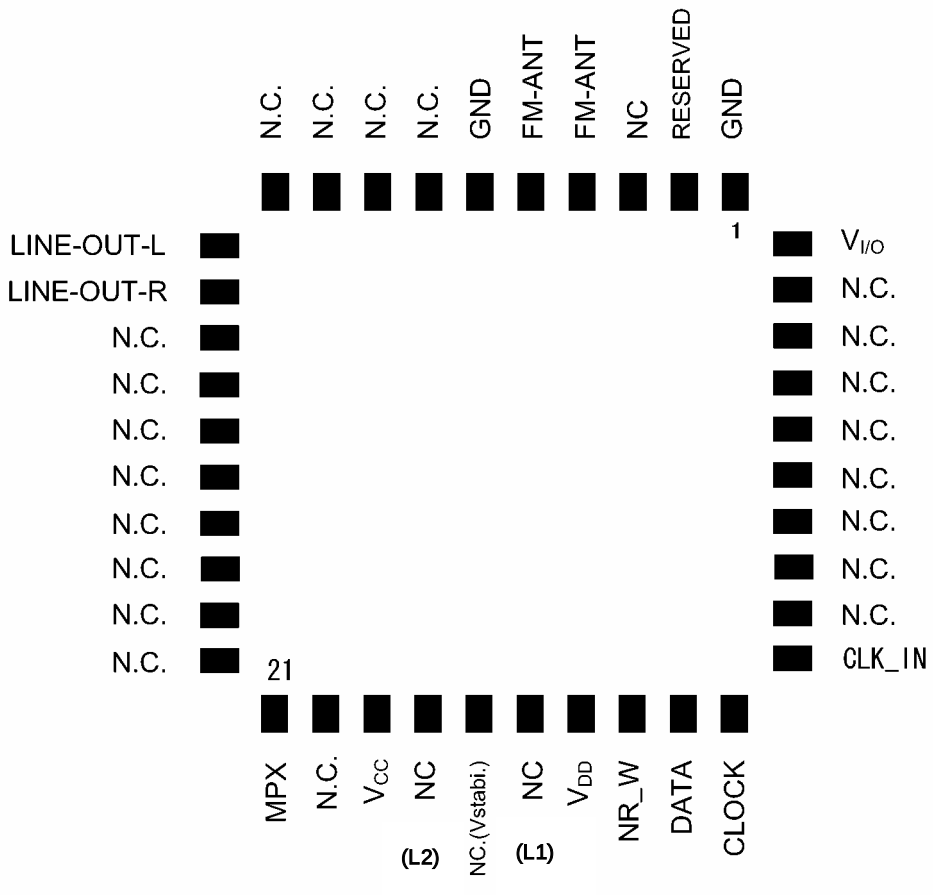
2.shift the received frequency lower side
For putting capacitor between L2(24 pin) and V_stabi_out(25pin) in addition between L1(26pin) and V_stabi_out(25pin) ,you can shift the received frequency lower side.

* If you use this IC,please check X um from 300um to 400um for optimization.

LV24000 Pin layout

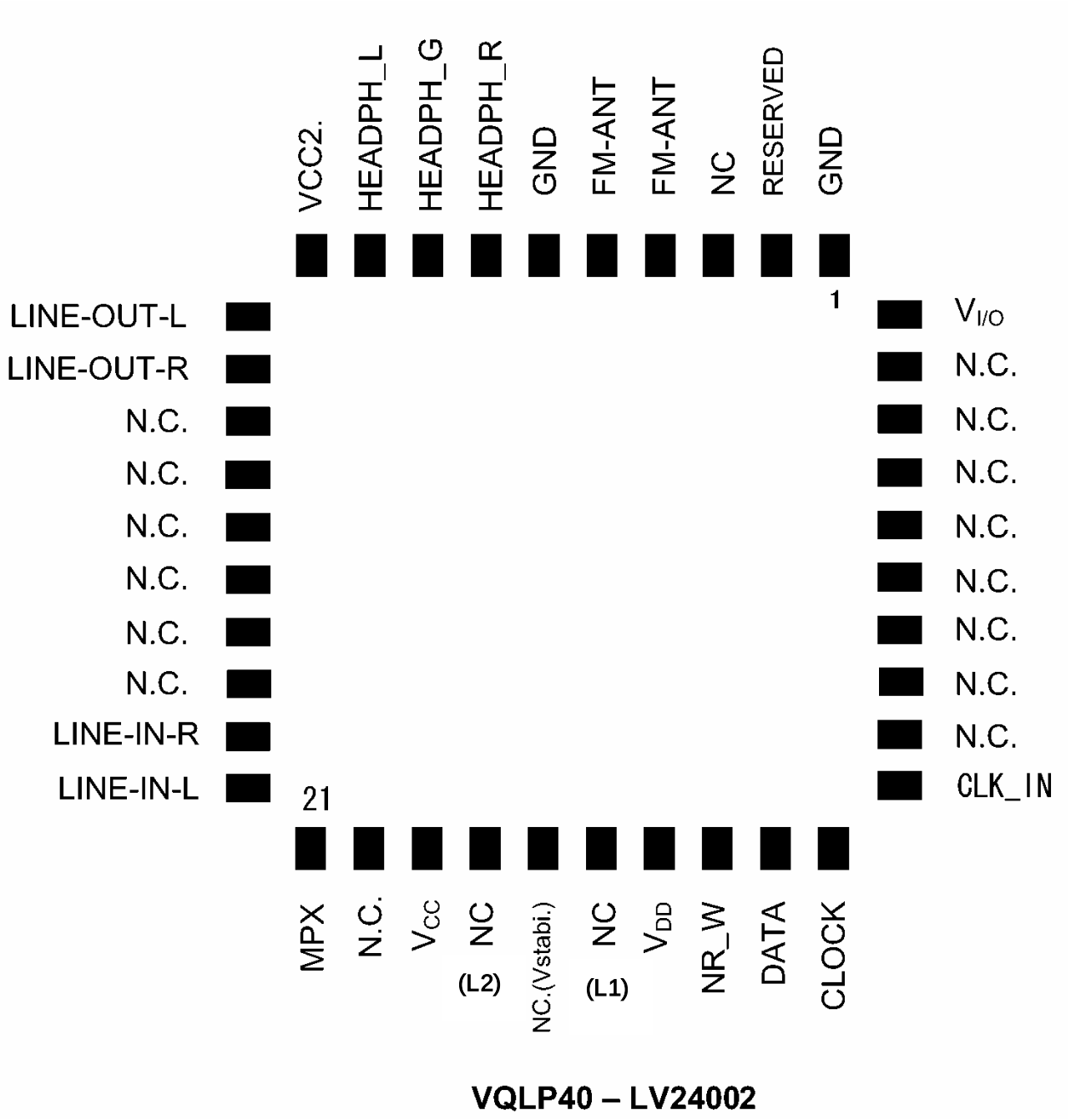


TSSOP24



VQLP40 – LV24000

LV24002 Pin layout



VQLP40 – LV24002

VQLP40 package Pin Description

Pin	LV24000LP	LV24002LP	Description	Remark	DC_bias
1	GND	GND	GND (Analog and Digital GND)		
2	RESERVED	RESERVED		Do not connect	
3	NC	NC			
4	FM-ANT1	FM-ANT1	Antenna input		
5	FM-ANT2	FM-ANT2	Antenna GND	Connect to GND	
6	GND	GND	GND(Analog and Digital GND)		
7	NC	HEADPH_R	Headphone Rch output		1.2V
8	NC	HEADPH_C	Headphone common	Not DC GND	1.2V
9	NC	HEADPH_L	Headphone Lch output		1.2V
10	NC	VCC2	Headphone supply voltage		
11	LINE-OUT-L	LINE-OUT-L	Radio Lch Line-output		1.2V
12	LINE-OUT-R	LINE-OUT-R	Radio Rch Line-output		1.2V
13	NC	NC			
14	NC	NC			
15	NC	NC			
16	NC	NC			
17	NC	NC			
18	NC	NC			
19	NC	LINE-IN-R	Rch Line-input		1.4V
20	NC	LINE-IN-L	Lch Line-input		1.4V
21	MPX	MPX	MPX-signal output		Vcc-0.3V
22	NC	NC			
23	VCC	VCC	Analog supply voltage		
24	NC (L2)	NC (L2)	Internal coil2	Do not connect	2.7V
25	Vstabi.	Vstabi.	Stabilizer voltage		2.7V
26	NC (L1)	NC (L1)	Internal coil1	Do not connect	2.7V
27	VDD	VDD	Digital supply voltage		
28	NR_W	NR_W	Digital interface Read/Write		
29	DATA	DATA	Digital interface DATA		
30	CLOCK	CLOCK	Digital interface Clock		
31	CLK_IN	CLK_IN	Reference clock-source input for measurement	Connect to GND if not used	
32	NC	NC			
33	NC	NC			
34	NC	NC			
35	NC	NC			
36	NC	NC			
37	NC	NC			
38	NC	NC			
39	NC	NC			
40	VI/O	VI/O	Digital interface supply voltage		

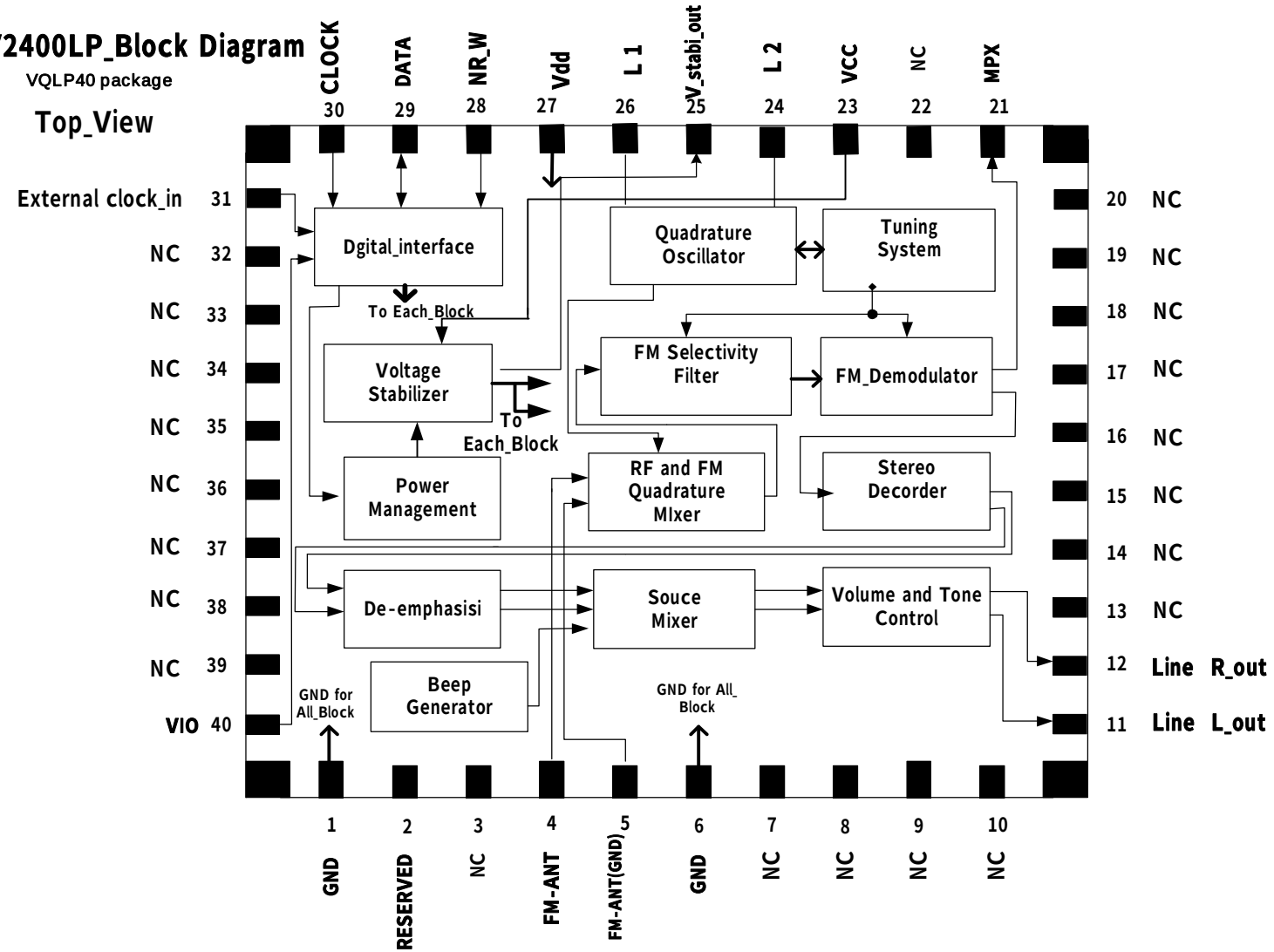
TSSOP24 package Pin Description

Pin	LV24000T	Description	Remark	DC_bias
1	VI/O	Digital interface supply voltage		
2	GND	GND(Analog and Digital GND)		
3	RESERVED		Do not connect	
4	FM-ANT1	Antenna input		
5	FM-ANT2	Antenna GND	Connect to GND	
6	GND	GND(Analog and Digital GND)		
7	NC			
8	NC			
9	NC			
10	NC			
11	LINE-OUT-L	Radio Lch Line-output		1.2V
12	LINE-OUT-R	Radio Rch Line-output		1.2V
13	NC			
14	NC			
15	MPX	MPX-signal output		Vcc-0.3V
16	VCC	Analog supply voltage		
17	L2	Coil2 (Inductor_terminal)		2.7V
18	Vstabi.	Stabilizer voltage		2.7V
19	L1	Coil1(inductor_terminal)		2.7V
20	VDD	Digital supply voltage		
21	NR_W	Digital interface Read/Write		
22	DATA	Digital interface DATA		
23	CLOCK	Digital interface Clock		
24	CLK_IN	Reference clock-source input for measurement	Connect to GND if not used	

LV2400LP_Block Diagram

VQLP40 package

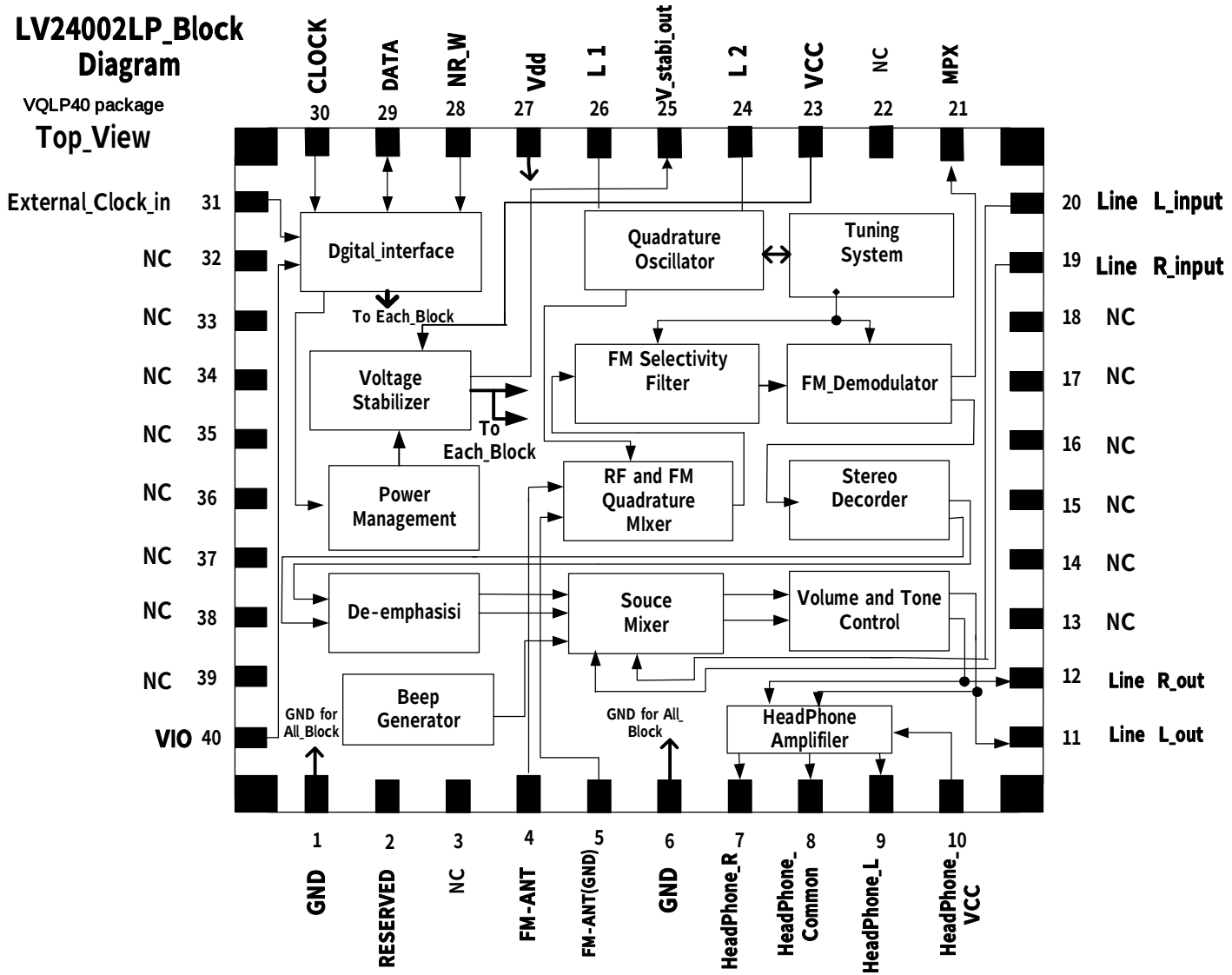
Top_View



LV24002LP_Block Diagram

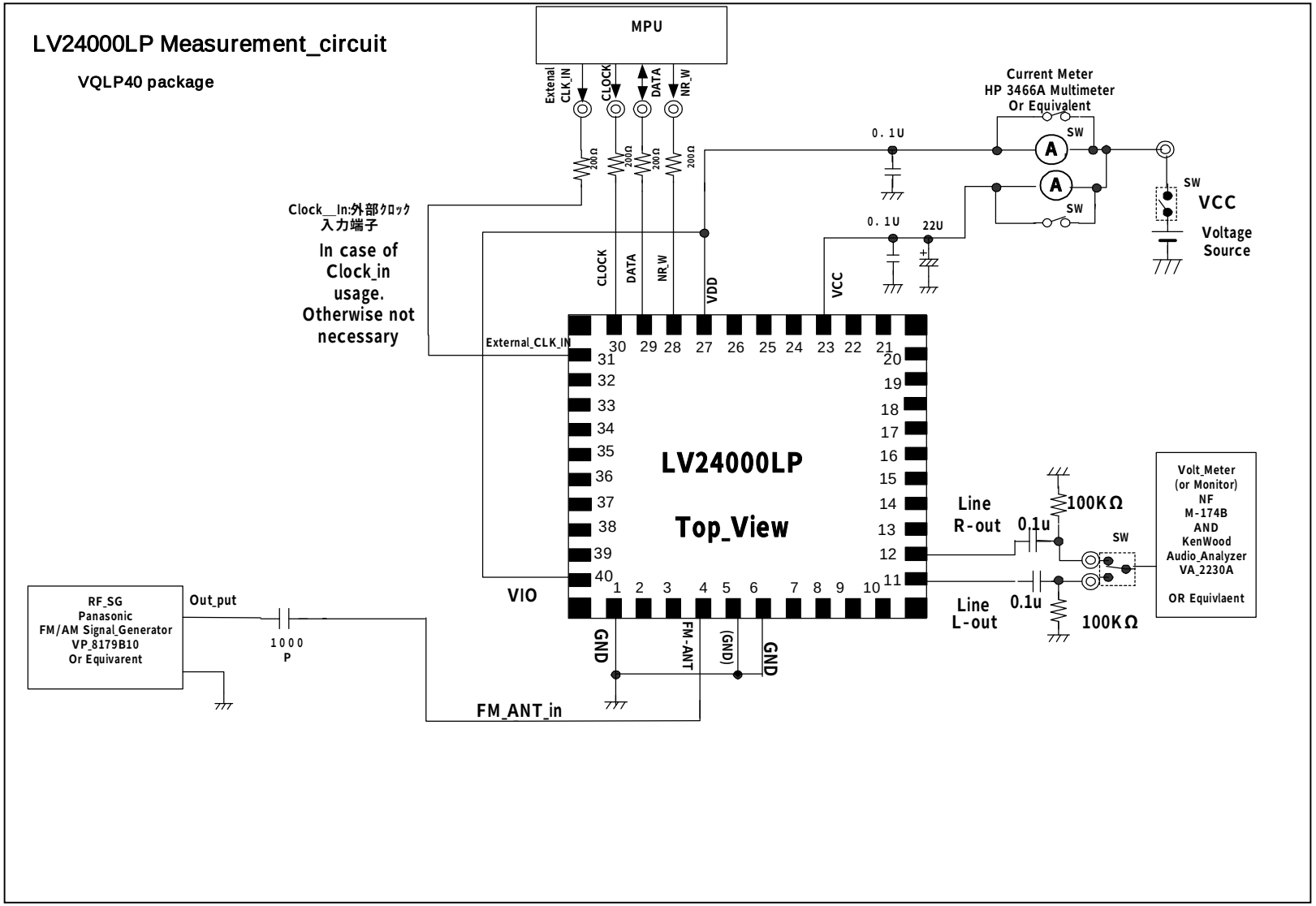
VQLP40 package

Top_View



LV24000LP Measurement_circuit

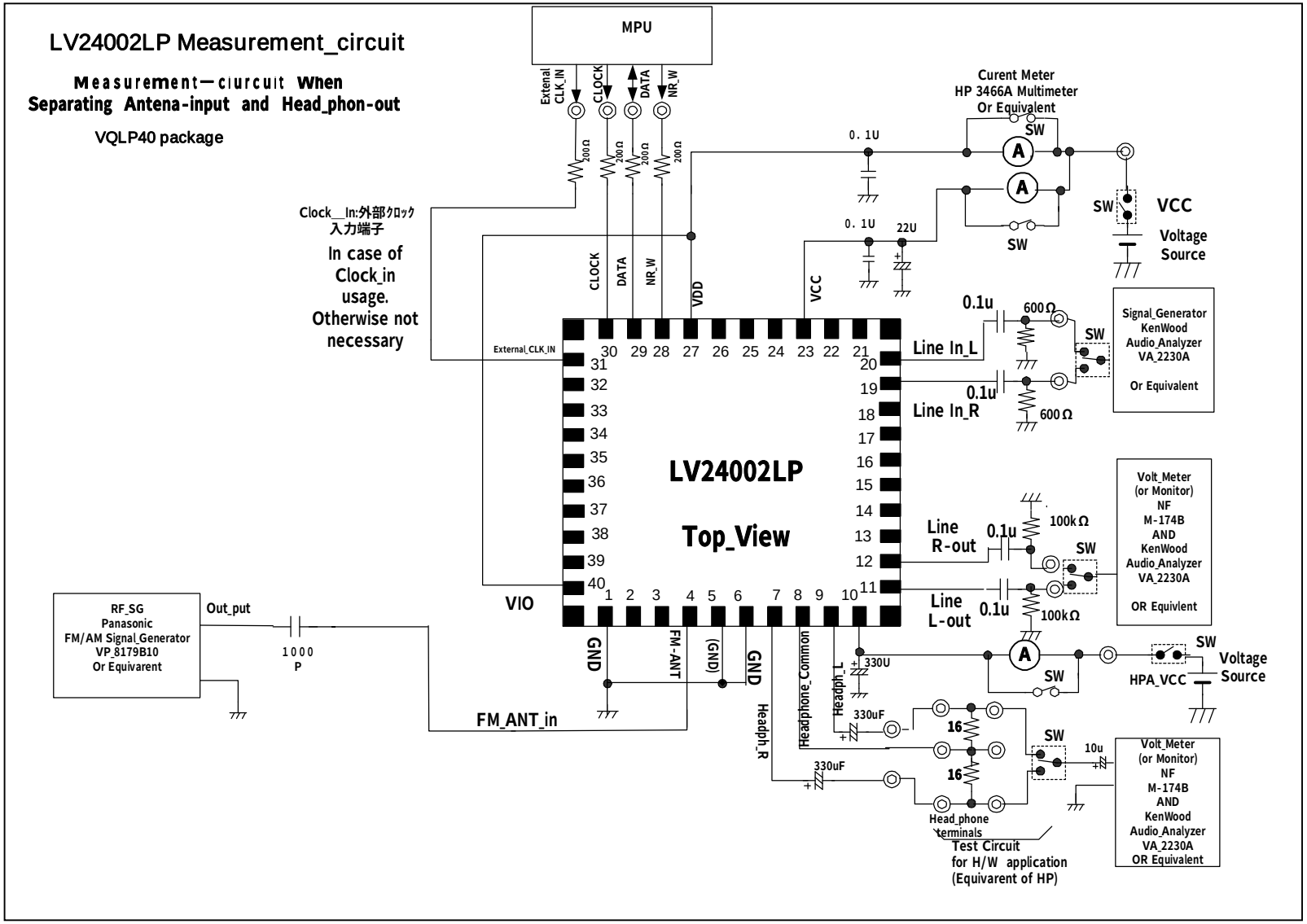
VQLP40 package



LV24002LP Measurement_circuit

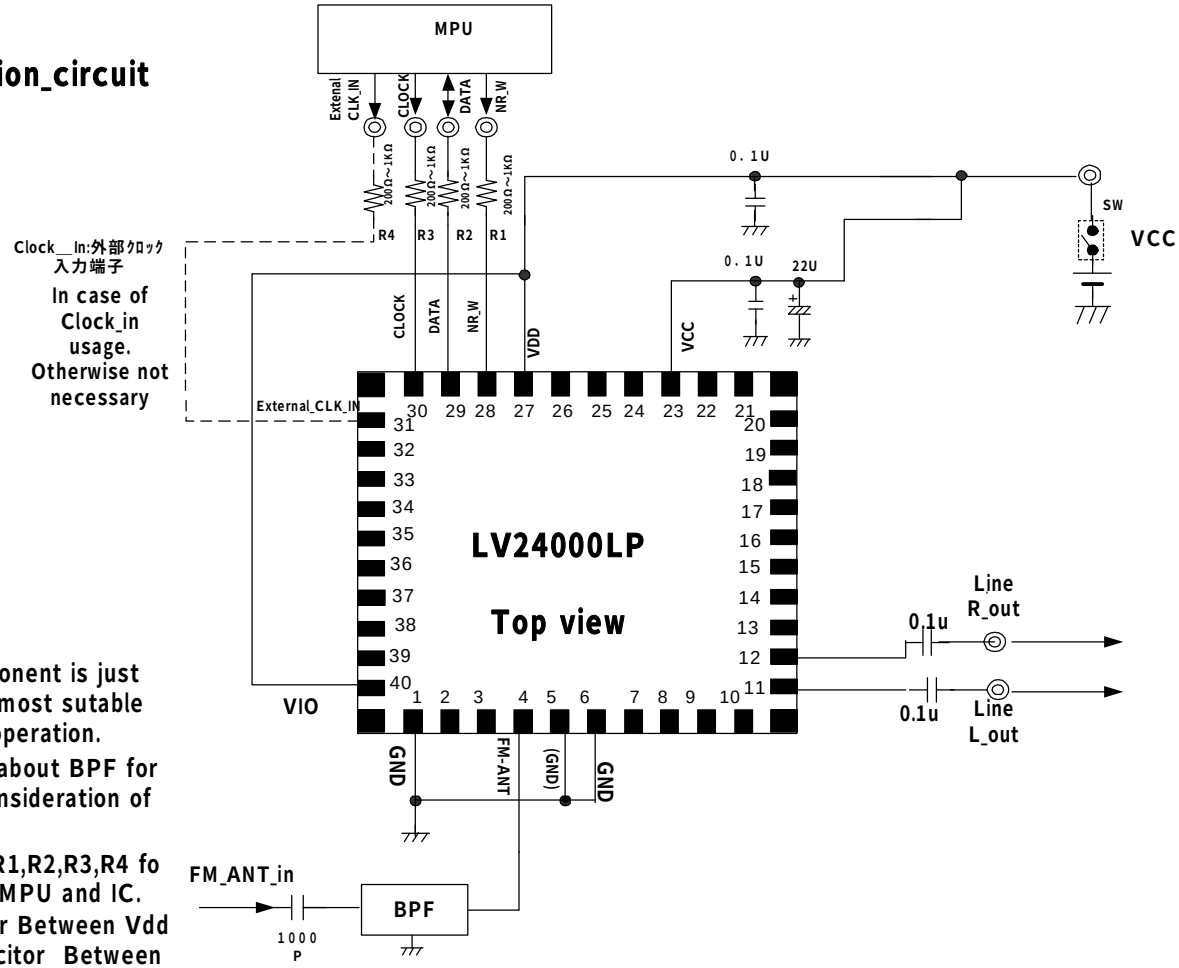
Measurement－ciurcuit When Separating Antena-input and Head_phon-out

VQLP40 package



LV24000LP application_circuit

VQLP40 package



Note1: Vale of Extenal Component is just reference. Please set most sutable value under Acutual_ operation.

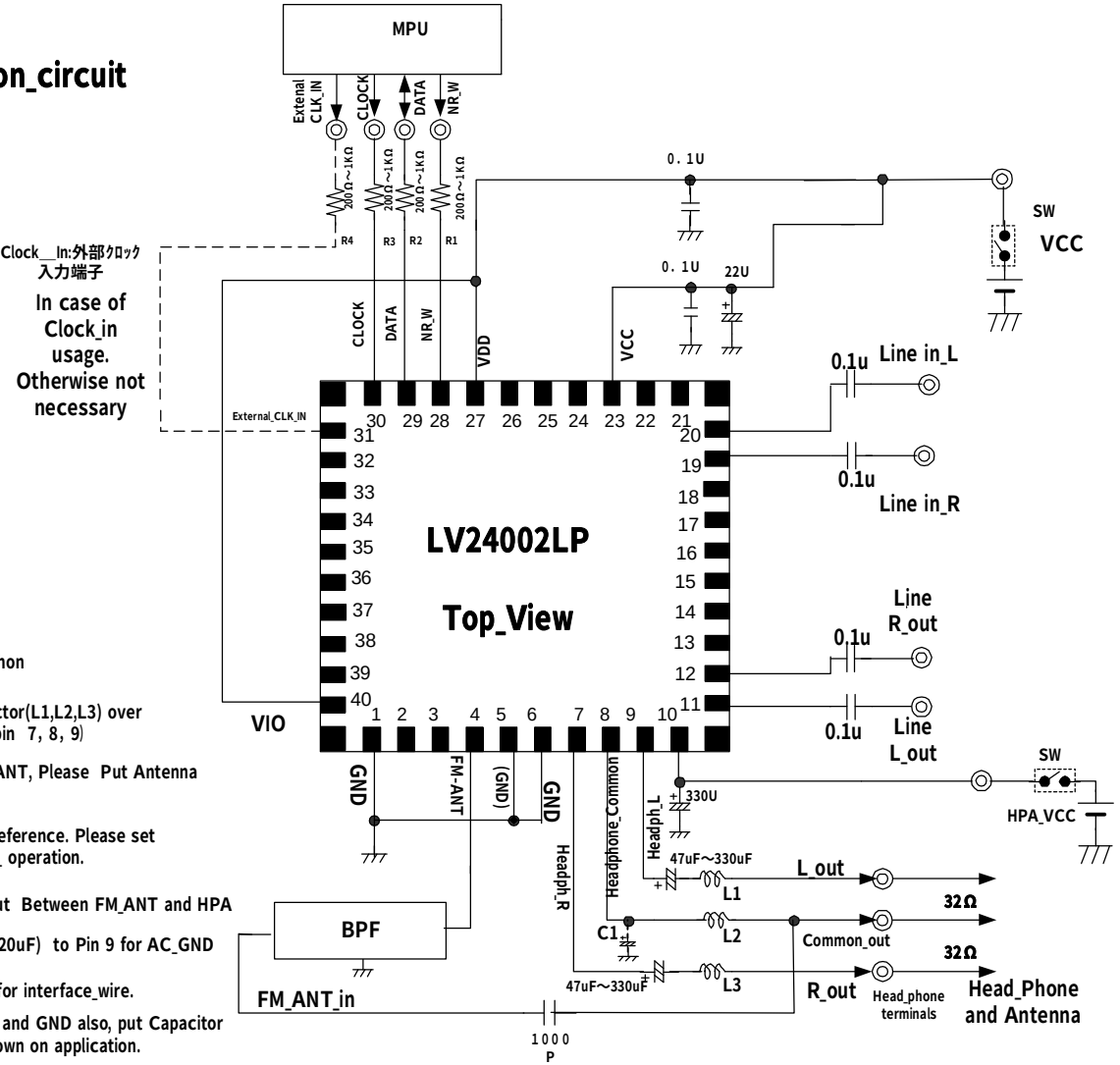
Note2: In case of necessary about BPF for FM_in, Please take Consideration of most suitable_value.

Note3: We recomend to put R1,R2,R3,R4 fo for interface between MPU and IC.

Note4: Please put Capacitor Between Vdd and GND also, put Capacitor Between Vcc and GND as shown on application.

LV24002LP application_circuit

VQLP40 package



Note1: Recommend to use 32ohm Head_phon

Note2: Recommend to use Value of Inductor(L1,L2,L3) over 820nH for Head_phone_out put(pin 7, 8, 9)

Note3: In case of not use Head_phone for ANT, Please Put Antenna Circuit ceparatly.

Note4: Vale of Extenal Component is just reference. Please set most sutable value under Acutual_ operation.

Note5: In case of necessary BPF, Please put Between FM_ANT and HPA

Note6: We recommend to put C1(100uF～220uF) to Pin 9 for AC_GND

Note7: We recommend to put R1,R2,R3,R4 for interface_wire.

Note8: Please put Capacitor Between Vdd and GND also, put Capacitor Between Vcc and GND as shown on application.

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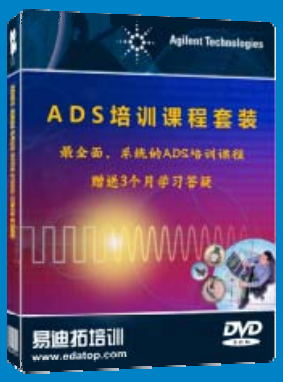

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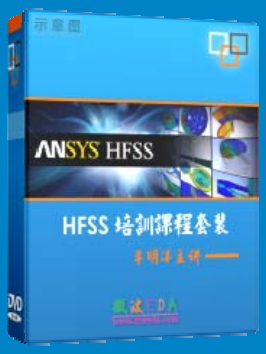

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