

# LV24000/02 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 (Data, 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

LV24000/02PL 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

## Specifications

### Maximum Ratings at Ta =25°C

| PARAMETER                   | SYMBOL              | CONDITIONS                                      | RATINGS    | UNIT |
|-----------------------------|---------------------|---|------------|------|
| Maximum Supply Voltage      | V <sub>CC</sub> max | Analog Supply Voltage                           | 6.0        | V    |
|                             | V <sub>DD</sub> max | Digital Supply Voltage                          | 5.0        | V    |
| Digital Input               | V <sub>IH</sub>     | Minimum Input Voltage for High Level            | 1.4        | V    |
|                             | V <sub>IL</sub>     | Maximum Input Voltage for Low Level             | 0.6        | V    |
| Digital Output              | I <sub>OL</sub>     | Maximum Output Current for Low Level            | 2.0        | mA   |
|                             | V <sub>OL</sub>     | Maximum Output Voltage for I <sub>OL</sub> =2mA | 0.6        | V    |
| Maximum Input Clock         | f <sub>clk</sub>    |   | 1          | MHz  |
| Allowable Power Dissipation | P <sub>d</sub> max  | Ta 70   | 140        | mW   |
| Storage Temperature         | T <sub>stg</sub>    |   | -40 ~ +125 |      |
| Operating Temperature       | T <sub>opr</sub>    |   | -20 ~ +70  |      |

### Operating Conditions at Ta = 25°C

$$V_{CC} = V_{DD}$$

| PARAMETER                      | SYMBOL              | CONDITIONS               | RATINGS   | UNIT |
|--------------------------------|---------------------|--------------------------|-----------|------|
| Recommended Supply Voltage     | V <sub>CC</sub>     | Analog Block             | 3.0       | V    |
|                                | V <sub>DD</sub>     | Digital Block            | 3.0       | V    |
| Operating Supply Voltage Range | V <sub>CC</sub> op  |                          | 2.7 ~ 5.0 | V    |
|                                | V <sub>DD</sub> op  |                          | 2.5 ~ 4.0 | V    |
|                                | V <sub>I/O</sub> op | Interface Supply Voltage | 1.6 ~ 4.0 | V    |

### Operating Characteristics at Ta = 25°C, V<sub>cc</sub>=3.0V , V<sub>dd</sub>=3.0V , Vol=14, Soft Mute / Stereo=off (Tentative)

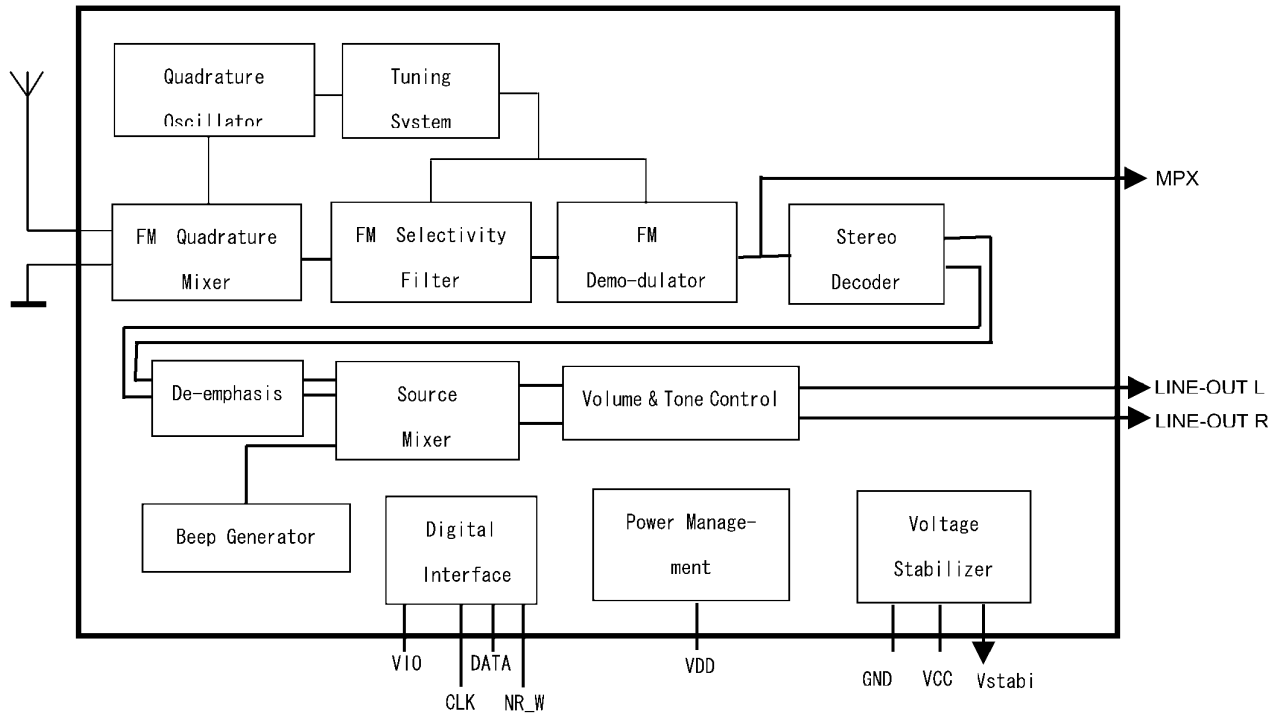
| PARAMETER                  | SYMBOL           | CONDITIONS                          | MIN | TYP | MAX | UNIT |
|----------------------------|------------------|-------------------------------------|-----|-----|-----|------|
| Operational Supply Current | I <sub>CCA</sub> | Analog Block at 60dBu input LV24000 |     | 18  | 22  | mA   |
|                            |                  | LV24002                             |     | 22  | 26  |      |
|                            | I <sub>CCD</sub> | Digital Block at 60dBu input        |     | 0.4 | 0.8 |      |
| Standby supply Current     | I <sub>CCA</sub> | Analog standby mode                 |     | 10  |     | uA   |
|                            |                  | Digital standby mode                |     | 10  |     |      |

| PARAMETER  | SYMBOL         | CONDITIONS   | MIN | TYP | MAX | UNIT             |
|--|----------------|--|-----|-----|-----|------------------|
| [ FM Receiving characteristics ; MONO ] : f <sub>c</sub> =80MHz, f <sub>m</sub> =1kHz, 22.5kHzdev. |                |  |     |     |     |                  |
| Input limiting voltage   | -3dB LS        | V <sub>in</sub> =60dBμ standard for a -3dB input             |     | 13  | 19  | dB μ<br>V<br>EMF |
| Practical sensitivity  | QS             | for 30dB signal to noise ratio input                         |     | 10  | 16  | dB μ<br>V<br>EMF |
| Demodulator Output level   | V <sub>o</sub> | V <sub>in</sub> =60dBu, 11pin output level                   | 60  | 100 | 140 | mV               |
| Channel balance  | CB             | V <sub>in</sub> =60dBu, ratio of 11pin to 12pin output level |     | 0   | 2   | dB               |

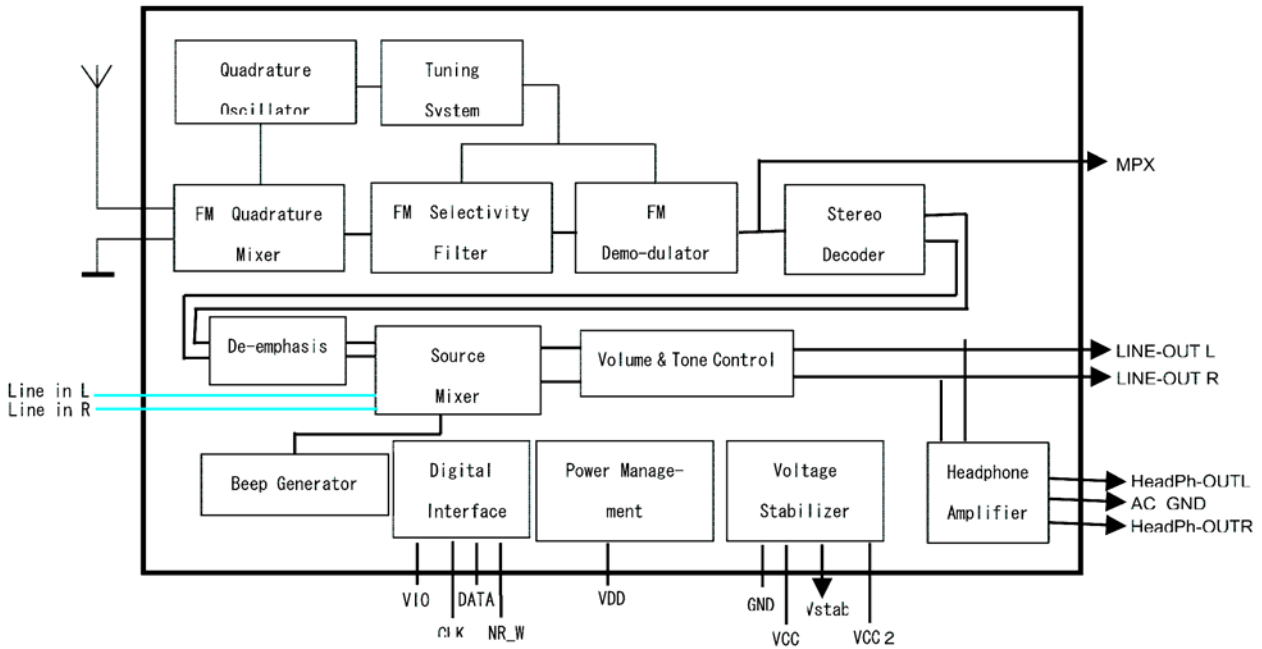
|  |          |                                    |    |     |     |     |
|--|----------|------------------------------------|----|-----|-----|-----|
| Signal to noise ratio  | S/N      | Vin=60dBu, 11pin output level      | 47 | 53  |     | dB  |
| Total harmonic distortion 1(MONO)  | THD1     | Vin=60dBu, 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 level for FS1 to FS2         | 14 | 20  | 26  | dBu |
| Muting attenuation   | Mute-Att | Vin=60dBu, 11pin output level      | 60 | 70  |     | dB  |
| [ FM Receiving characteristics ;STEREO ] : fc=80MHz, fm=1kHz, 22.5KHzdev, L+R=90%, Pilot=10%, Vin=60dB $\mu$ |          |                                    |    |     |     |     |
| Separation   | SEP      | 11pin 12pin output level           | 20 | 25  |     | dB  |
| Total harmonic distortion (STEREO)   | THD-ST   | Main-mod, 11pin output             |    | 0.6 | 1.8 | %   |
| [ Head phone power characteristics ;LV24002 ] : Line in , fc=1KHz, RL=16 , Vol= 14                           |          |                                    |    |     |     |     |
| Output power   | Po       | THD=10%                            |    | 3   | 5   | mW  |
| Total harmonic distortion  | THD-ST   | Po=1mW                             |    | 3   | 5   | %   |
| Output noise voltage   | Vno      | Rg=10K 、 BPF=200Hz ~ 15KHz         |    | 0.5 | 3   | mV  |

# Block Diagram

## LV24000

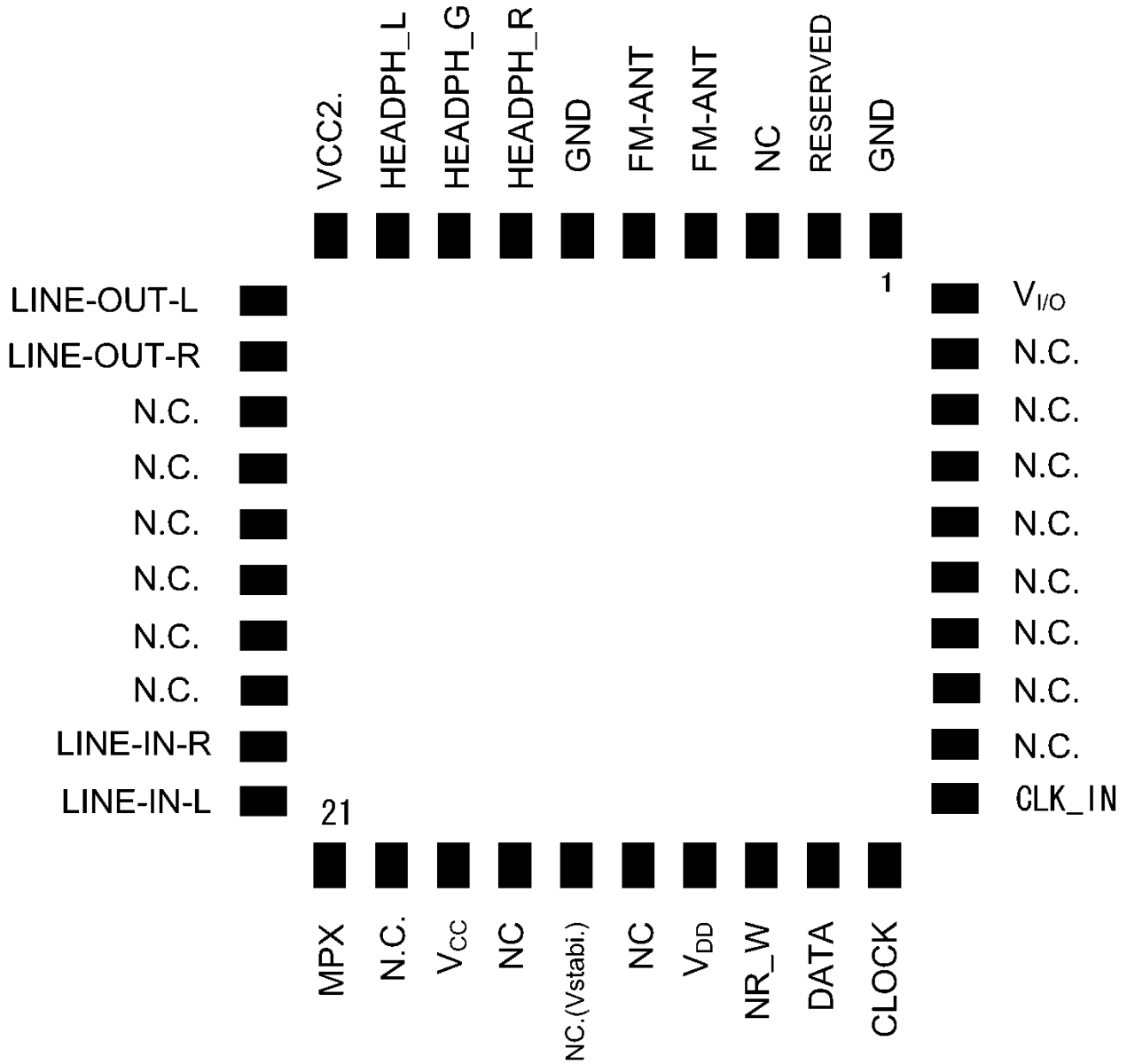


## LV24002



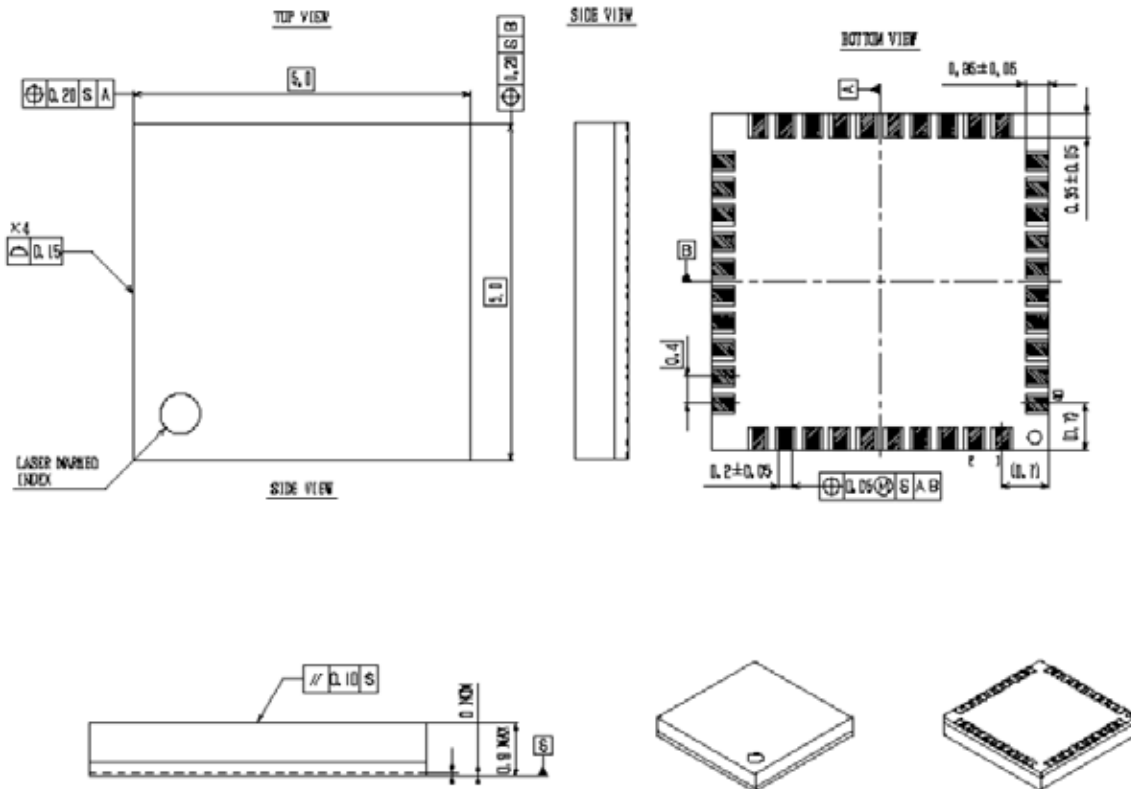
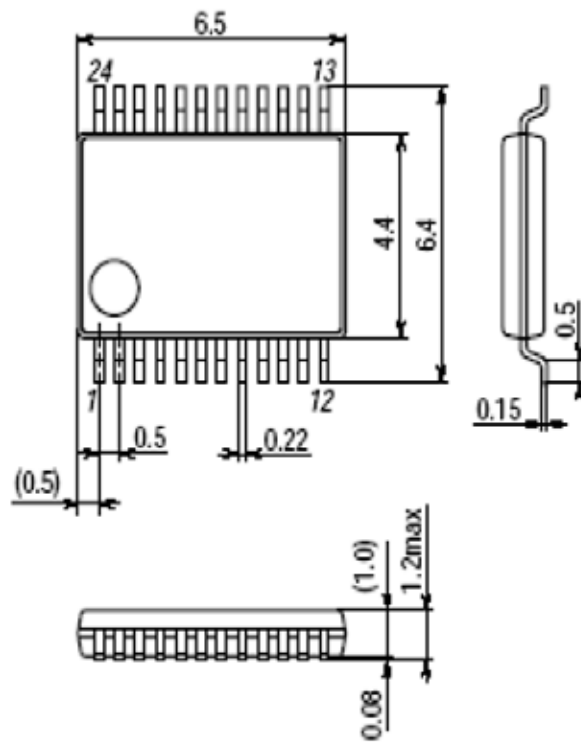


LV24002 Pin layout



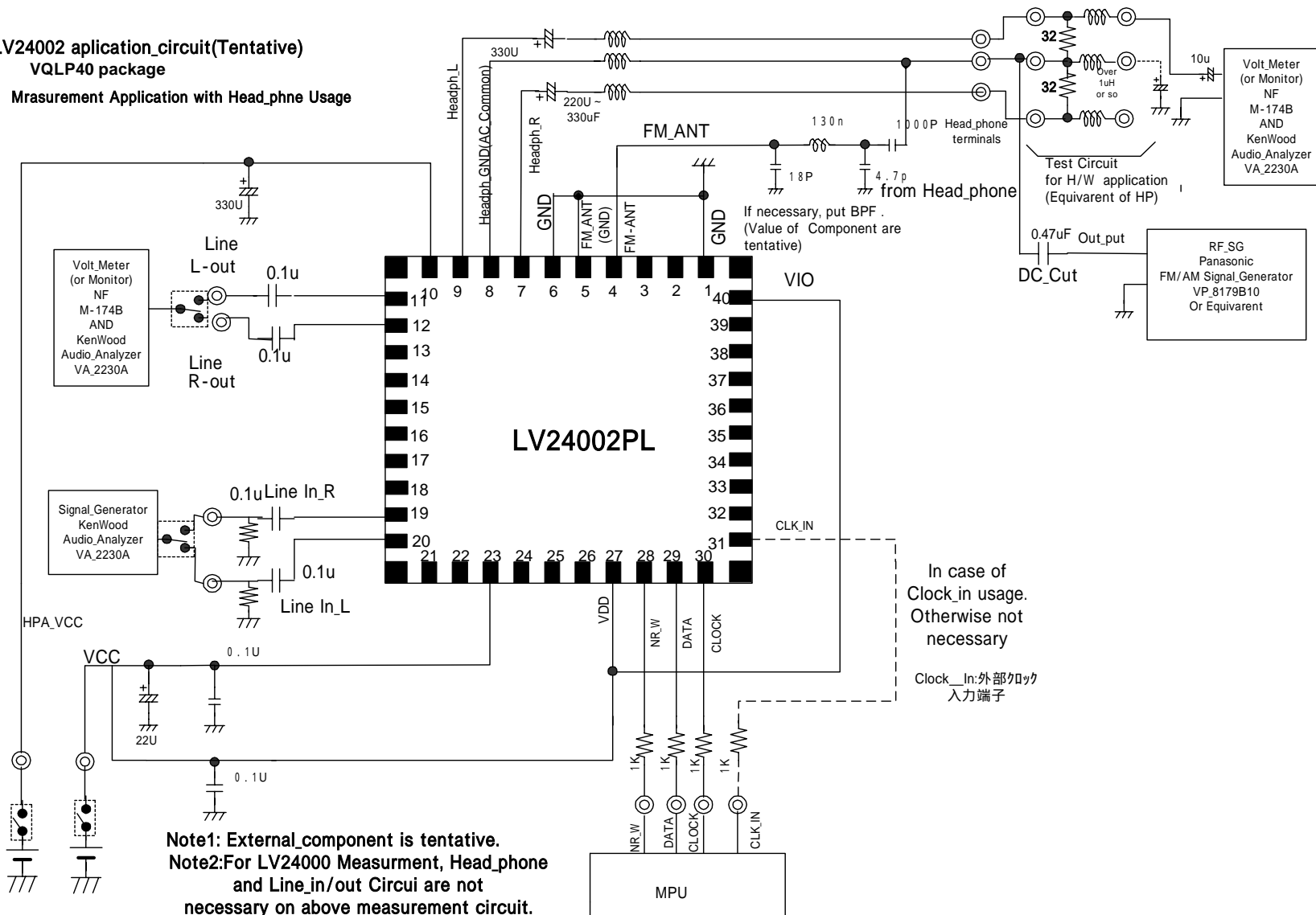
VQLP40 - LV24002

## IC Package Dimension



VCLP40 (5, 0x5, 0) X01

**LV24002 application\_circuit(Tentative)**  
**VQLP40 package**  
**Measurement Application with Head\_pne Usage**



**LV24002 application\_circuit(Tentative)**  
**VQLP40 package**  
**Measurement - circuit When Separating**  
**Antenna-input and Headphon-out**

