



**SANYO Semiconductors**

# DATA SHEET

An ON Semiconductor Company

## LV24020LP — Bi-CMOS IC Ultra-compact FM tuner IC for mobile set

### Overview

The LV24020LP is FM tuner IC's that requires absolutely no external components.

They incorporates not only the FM tuner functions as well in a compact VQLP package with dimensions of only 5mm×5mm×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

- FM FE
- FM IF
- MPX Stereo Decoder
- Tuning

### 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

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# LV24020LP

## Specifications

### Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V <sub>CC</sub> max	Analog block supply voltage	6.0	V
	V <sub>DD</sub> max	Digital block supply voltage	5.0	V
Digital input voltage	V <sub>IN1</sub> max	Clock, Data, NR_W	V <sub>DD</sub> +0.3	V
	V <sub>IN2</sub> max	External_clk_in	V <sub>DD</sub> +0.3	V
Allowable power dissipation	P <sub>d</sub> max	Ta ≤ 70°C	140	mW
Operating temperature	T <sub>opr</sub>		-20 to +70	°C
Storage temperature	T <sub>stg</sub>		-40 to +125	°C

### Operating Condition at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	V <sub>CC</sub>	Analog block supply voltage	3.0	V
	V <sub>DD</sub>	Digital block supply voltage	3.0	V
Operating supply voltage range	V <sub>CC</sub> op		2.7 to 5.0	V
	V <sub>DD</sub> op		2.5 to 4.0	V
	V <sub>IO</sub> op	Interface supply voltage	1.8 to 4.0	V

Note: Power supply voltage V<sub>IO</sub> equal V<sub>DD</sub>, or V<sub>IO</sub> < V<sub>DD</sub> (V<sub>IO</sub> ≤ V<sub>DD</sub>)

### Interface Conditions at Ta = -20 to +70°C, V<sub>SS</sub> = 0V

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Supply voltage	V <sub>DD</sub>		2.5		4.0	V
Digital part input	V <sub>IH</sub>	High level input voltage range	0.7V <sub>DD</sub>		V <sub>DD</sub>	V
	V <sub>IL</sub>	Low level input voltage range	0		0.6	V
Digital part output	I <sub>OL</sub>	Low level output current	2.0			mA
	V <sub>OL</sub>	Low level output voltage I <sub>OL</sub> =2mA			0.6	V
Clock input frequency	f <sub>clk</sub>	3wire_bus (29pin) clock frequency			0.7	MHz
External clock frequency	f <sub>clk_ext</sub>	CLK_IN (31pin) frequency	32k		14M	Hz

Note: CLK\_IN (31pin) can input sign wave.

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**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 = 0010

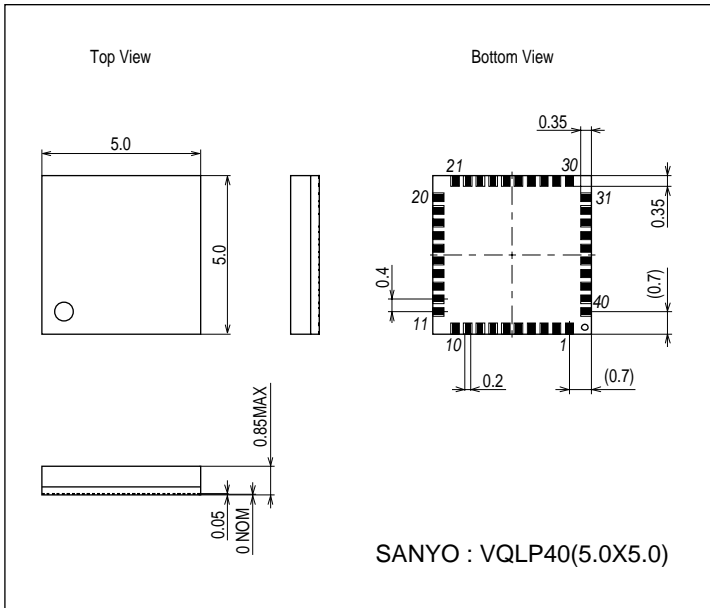
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Operational supply current	ICCA	Analog Block at 60dB $\mu$ input The 23pin is measured		14	17	mA
	ICCD	Digital Block at 60dB $\mu$ input The 27, 40 pins are measured.	0.2	0.4	0.8	mA
Standby supply current	ICCA	Analog standby mode The 23 pin is measured.		3	30	$\mu$ A
	ICCD	Digital standby mode The 27, 40 pins are measured.		3	30	$\mu$ A
FM coverd frq	F_range		76		108	MHz
[FM receiving characteristics ; MONO]: fc=80MHz, fm=1kHz, 22.5kHzdev. soft_stereo, soft_mute, Buss, Treble are all OFF.						
Input limiting voltage	-3dB LS	V <sub>IN</sub> =60dB $\mu$ standard for a -3dB input		13	19	dB $\mu$ V EMF
Practical sensitivity	QS1	for 30dB signal to noise ratio input De-emphasis is 75 $\mu$ s SG open		10	16	dB $\mu$ V EMF
Practical sensitivity	QS2	for 26dB signal to noise ratio input De-emphasis is 75 $\mu$ s SG close		1.25		$\mu$ V
Demodulator output level	V <sub>O</sub>	V <sub>IN</sub> =60dB $\mu$ , 11pin output level	50	90	130	mV
Channel balance	CB	V <sub>IN</sub> =60dB $\mu$ , ratio of 11pin to 12pin output level	-2	0	2	dB
Signal to noise ratio	S/N	V <sub>IN</sub> =60dB $\mu$ , 11pin output level	48	58		dB
Total harmonic distortion 1 (MONO)	THD1	V <sub>IN</sub> =60dB $\mu$ , 22.5kHzdev, 11pin output		0.4	1.5	%
Total harmonic distortion 2 (MONO)	THD2	V <sub>IN</sub> =60dB $\mu$ , 75kHzdev, 11pin output		1.3	3	%
Field strength level	FS	Input level for FS1 to FS2	8	18	27	dB $\mu$
Muting attenuation	Mute-Att	V <sub>IN</sub> =60dB $\mu$ , 11pin output level	60	70		dB
[FM receiving characteristics ; STEREO]: fc=80MHz, fm=1kHz, V <sub>IN</sub> =60dB $\mu$ V, 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	%

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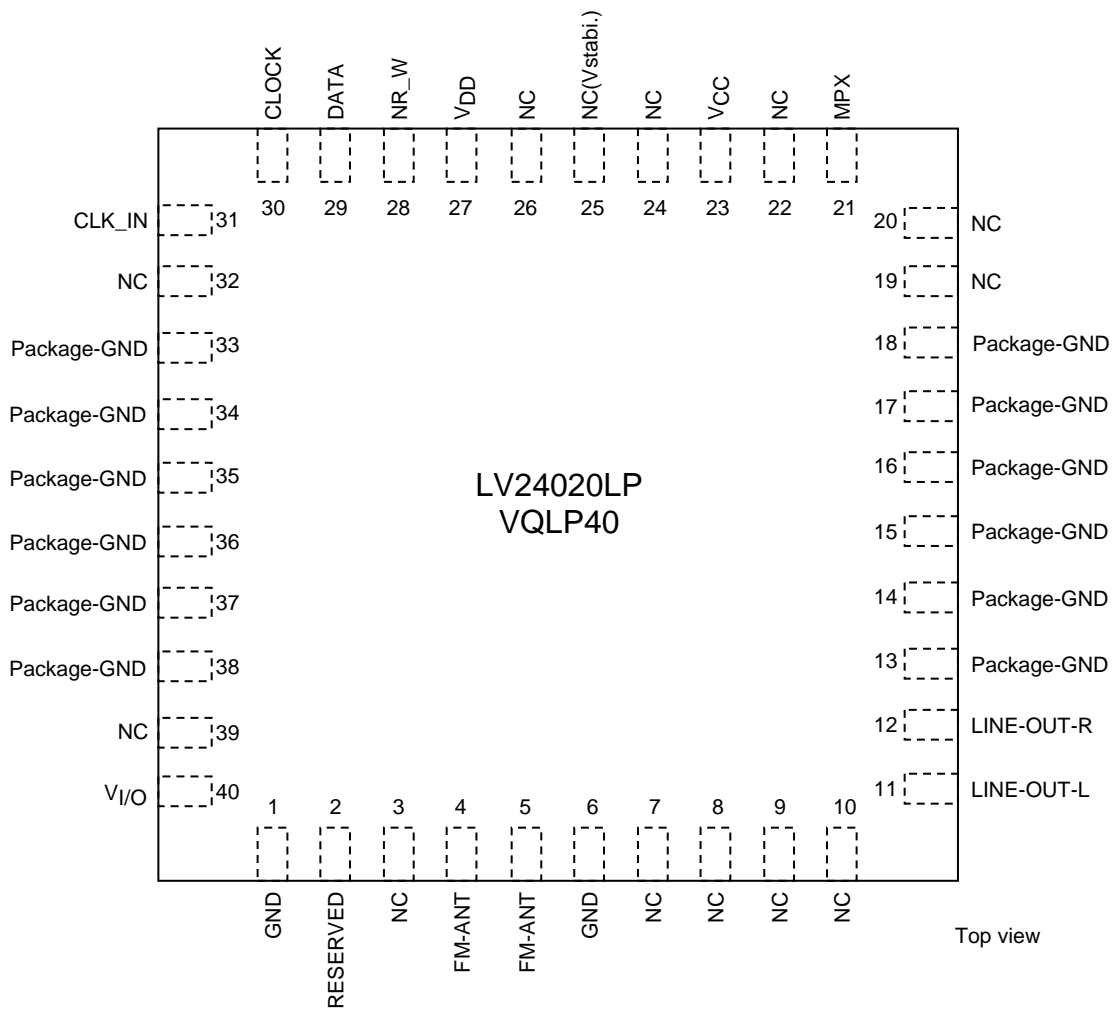
## Package Dimensions

unit : mm (typ)

3302A



## Pin Assignment



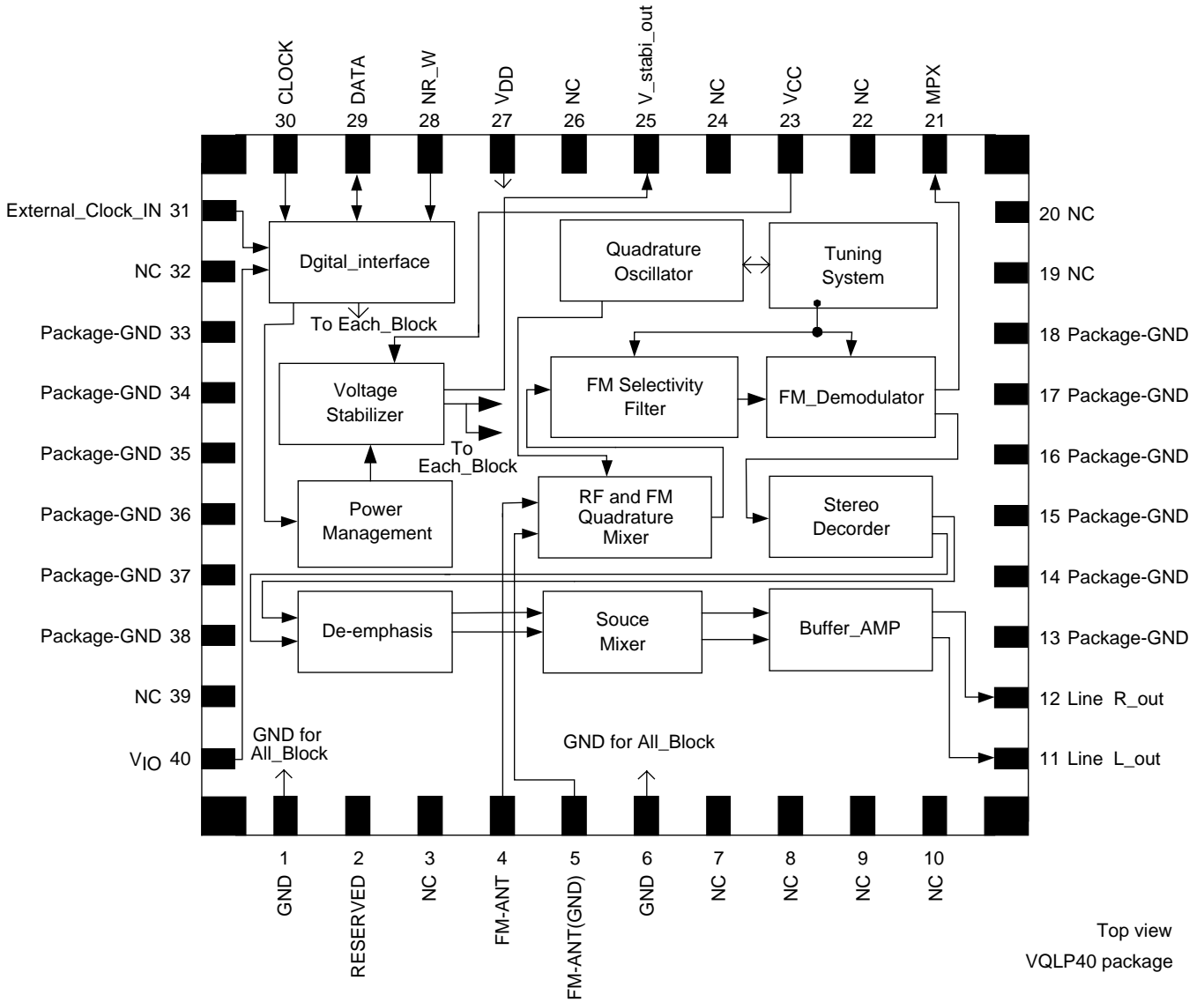
## LV24020LP

### VQLP40 package Pin Description

Pin	LV24020LP	Description	Remark	DC_bias
1	GND	GND (Analog and Digital GND)		
2	RESERVED		Do not connect	
3	NC			
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	Package-GND	GND for Package-shield		
14	Package-GND	GND for Package-shield		
15	Package-GND	GND for Package-shield		
16	Package-GND	GND for Package-shield		
17	Package-GND	GND for Package-shield		
18	Package-GND	GND for Package-shield		
19	NC			
20	NC			
21	MPX	MPX-signal output		V <sub>CC</sub> -0.3V
22	NC			
23	V <sub>CC</sub>	Analog supply voltage		
24	NC			
25	V <sub>stabi.</sub>	Stabilizer voltage		2.7V
26	NC			
27	V <sub>DD</sub>	Digital supply voltage		
28	NR_W	Digital interface Read/Write		
29	DATA	Digital interface DATA		
30	CLOCK	Digital interface Clock		
31	CLK_IN	Reference clock-source input for measurement	Connect to GND if not used	
32	NC			
33	Package-GND	GND for Package-shield		
34	Package-GND	GND for Package-shield		
35	Package-GND	GND for Package-shield		
36	Package-GND	GND for Package-shield		
37	Package-GND	GND for Package-shield		
38	Package-GND	GND for Package-shield		
39	NC			
40	V <sub>I/O</sub>	Digital interface supply voltage		

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## Block Diagram

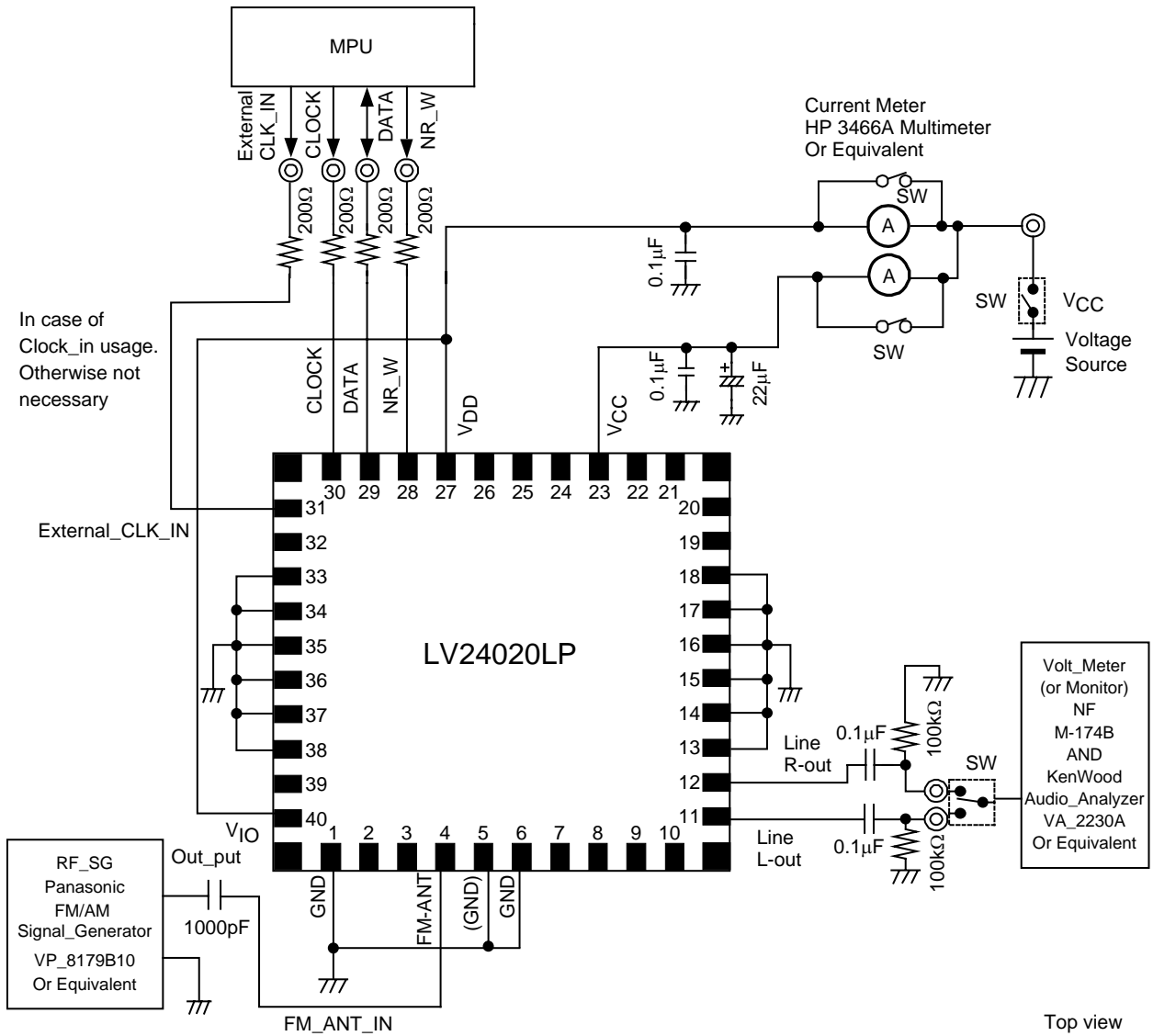


Top view  
VQLP40 package

ILV000223

# LV24020LP

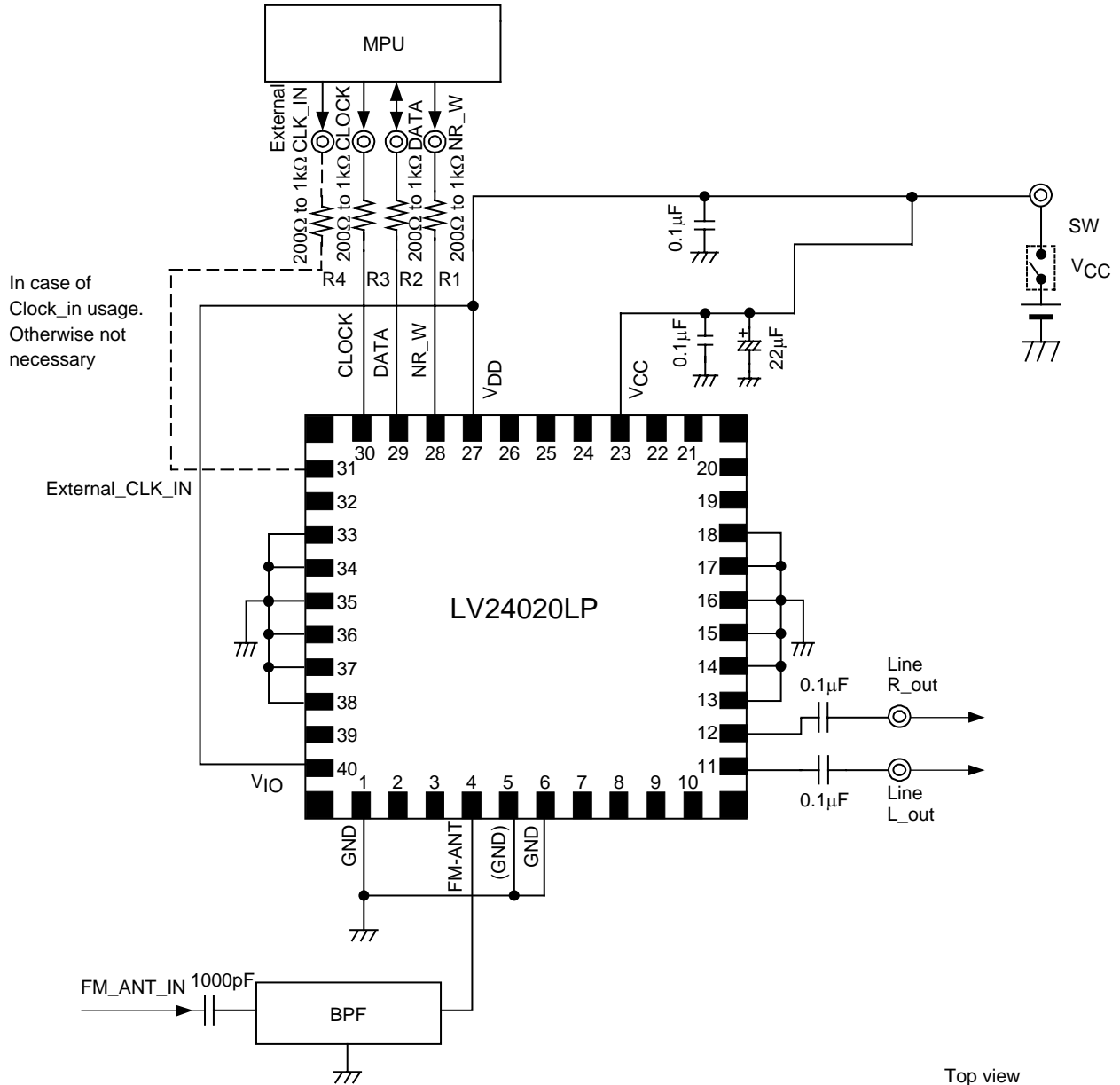
## Measurement Circuit



Top view  
VQLP40 package

ILV000224

Application Circuit



Top view  
VQLP40 package

ILV000225

Note1: Vale of External Component is just reference. Please set most suitable value under Aactual\_operation.

Note2: In case of necessary about BPF for FM\_in, Please take Consideration of most suitable\_value.

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

Note4: Please put Capacitor Between V<sub>DD</sub> and GND also, put Capacitor Between V<sub>CC</sub> and GND as shown on application.

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