



# LV2151V

## 2.0 GHz PLL Frequency Synthesizer IC

### Preliminary

### Overview

The SANYO LV2151V is a 2.0 GHz PLL frequency synthesizer IC that features low-voltage operation and low current drain and is suitable for CATV, DAB, and mobile phone systems.

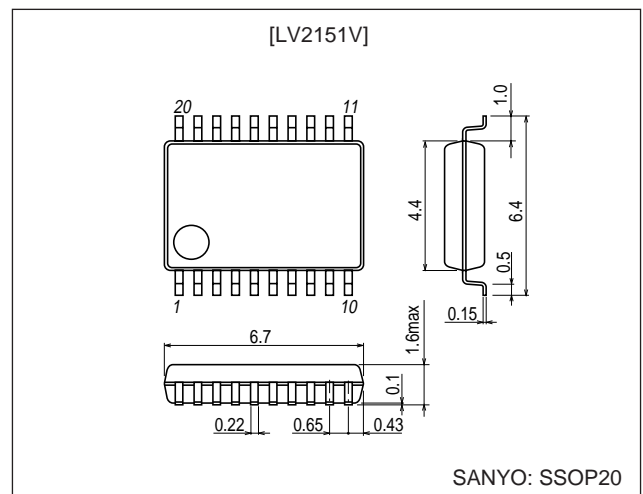
### Features

- A wide range of operating frequency from 0.2 to 2.0 GHz
- I<sup>2</sup>C bus/ 3-wire bus selective. (For I<sup>2</sup>C bus WRITE mode only)
- Includes three ports for band switch
- Includes unlock detect indicator.
- Battery saving mode
- 2.7V to 3.5 V operation
- Small package 20-pin SSOP (Lead pitch 0.65mm)

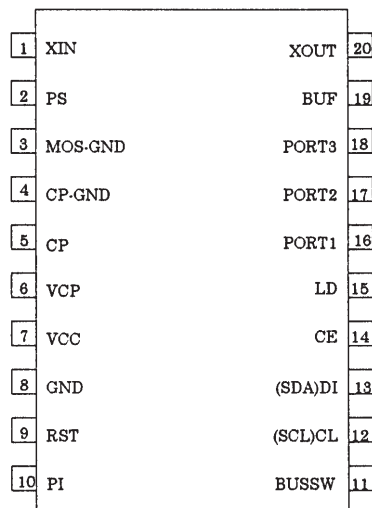
### Package Dimensions

unit: mm

#### 3179A-SSOP20



### Pin Assignment



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## LV2151V

### Specifications

#### Absolute Maximum Ratings at Ta = 25°C

Parameter	Symbol	Pin	Conditions	Ratings	Unit
Maximum supply voltage	V <sub>CC</sub> max	V <sub>CC</sub> , VCP		4.5	V
Maximum input voltage	V <sub>in</sub> max	SCL(CL), SDA(DI) CE, PS, RST, BUSSW		-0.3 to V <sub>CC</sub> + 0.3	V
Maximum output voltage	V <sub>out</sub> max	LD, PORT1 to 3, SDA(DI)		-0.3 to V <sub>CC</sub> + 0.3	V
Maximum output current1	I <sub>OUT</sub> max1	PORT1 to 3, SDA(DI)		4	mA
Maximum output current2	I <sub>OUT</sub> max2	LD		0.7	mA
Allowable power dissipation	Pd max		Ta ≤ 85°C	50	mW
Operating temperature	Topr			-30 to +85	°C
Storage temperature	Tstg			-50 to +125	°C

#### Operating Conditions at Ta = 25°C

Parameter	Symbol	Pin	Ratings			Unit
			min	typ	max	
Recommended power supply voltage	V <sub>CC</sub>	V <sub>CC</sub> , VCP		3.0		V
Operating voltage range	V <sub>CCOP</sub>	V <sub>CC</sub> , VCP	2.7		3.5	V

#### Allowable Operating Ranges at Ta = -30 to +85°C

Parameter	Symbol	Pin	Conditions	Ratings			Unit
				min	typ	max	
Supply voltage	V <sub>CC</sub>	V <sub>CC</sub> , VCP		2.7		3.5	V
High-level input voltage	V <sub>IH</sub>	SCL(CL), SDA(DI), CE, PS, RST, BUSSW		V <sub>CC</sub> *0.7		V <sub>CC</sub>	V
Low-level input voltage	V <sub>IL</sub>	SCL(CL), SDA(DI), CE, PS, RST, BUSSW		0		0.6	V
Input frequency	fin(1)	XIN	AC Coupled	4		22	MHz
	fin(2)	PI	*	0.2		2.0	GHz
Input amplitude	Vin(1)	XIN	AC Coupled	-12		10	dBm
	Vin(2)	PI	*	-12		0	dBm
Guaranteed crystal oscillation	Xtal	XIN, XOUT		4		22	MHz

Note: \*50 Ω terminate (0 dBm = 0.224 Vrms)

#### Electrical Characteristics at Ta = 25°C, V<sub>CC</sub> = 3.0 V

Parameter	Symbol	Pin	Conditions	Ratings			Unit
				min	typ	max	
Low-level output voltage1	V <sub>OL1</sub>	LD	I <sub>O</sub> = 0.5 mA			0.4	V
Low-level output voltage2	V <sub>OL2</sub>	SDA(DI), PORT1 to 3	I <sub>O</sub> = 3.0 mA			0.4	V
Output off leak current	I <sub>OFF</sub>	LD, PORT1 to 3	V <sub>O</sub> = 3.0 V			1	μA
CP Output off leak current	I <sub>OFFCP</sub>	CP	V <sub>O</sub> = 1.5 V			100	nA
CP output current	I <sub>cp</sub>	CP	V <sub>O</sub> = 1.5 V		±6.5		mA
High-level input current1	I <sub>H1</sub>	SCL(CL), SDA(DI), CE, PS, RST, BUSSW	V <sub>i</sub> = 3.0 V			5	μA
High-level input current2	I <sub>H2</sub>	XIN			3		μA
Low-level input current1	I <sub>L1</sub>	SCL(CL), SDA(DI), CE, PS, RST, BUSSW	V <sub>i</sub> = 0 V			5	μA
Low-level input current2	I <sub>L2</sub>	XIN			3		μA
Supply current	I <sub>cco</sub>	V <sub>CC</sub> + VCP	*1		7.0		mA
Standby current	I <sub>sb</sub>	No signal input	Power saving mode		0.4		mA

Note: \*PI = 2000 MHz, V<sub>pi</sub> = 0 dBm, RI = 19.2 MHz, V<sub>ri</sub> = 0 dBm  
Other input pins = 0 V, I/O pins = open, CP off, output pins = high

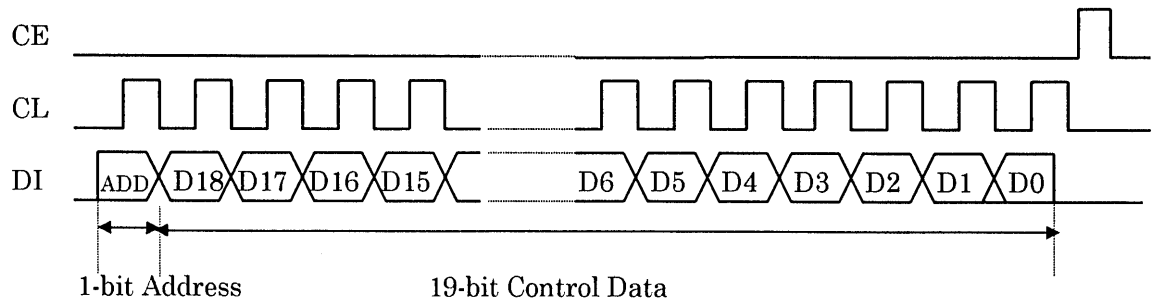
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### Pin Descriptions

Pin	Symbol	I/O	Description
1 20	XIN XOUT	CMOS input	Crystal oscillator connection pins.
2	PS	CMOS input with a pull-down resistor built in.	Power saving switch. "Open or Low": Power saving mode "High": Active mode
3	V <sub>SS</sub>		Ground pin for logic system
4	CP-GND		Ground pin for charge pump. (Fixed current output)
5	CP	BIP output	Charge pump output. (Fixed current output)
6	VCP		V <sub>CC</sub> supply for charge pump.
7	V <sub>CC</sub>		V <sub>CC</sub> supply. (Except charge pump circuit)
8	GND		Ground pin for RF block.
9	RST	CMOS input with a pull-up resistor built in.	Reset pin for I <sup>2</sup> C bus. Connect capacitor to GND. "Open or High" Release "Low" Reset
10	PI	Bipolar input	Comparator signal input. VCO output must be AC coupled to input.
11	BUSSW	CMOS input with a pull-up resistor built in.	Serial data select input. "Open or High" I <sup>2</sup> C bus "Low" 3-wire bus
12 13 14	SCL(CL) SDA(DI) CE	CMOS input	Data input pins  CE is used as an address selector pin if I <sup>2</sup> C bus is used.
15	LD	NPN transistor open collector output	PLL unlock detector output pin.
16 17 18	PORT1 PORT2 PORT3		Output port pins for band switch.
19	BUF	Bipolar output	Buffer output pin for crystal oscillator.

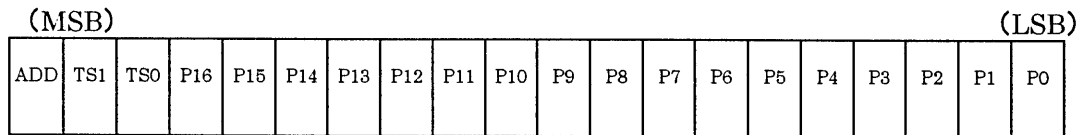
## Data Format

(1) 3-Wire Bus (BUSSW pin set low.)



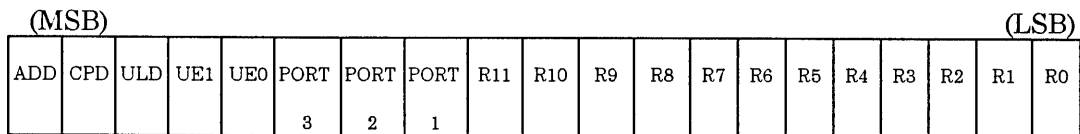
### 1. Programmable Counter and Test Mode

ADD latch address data must be set to 1.

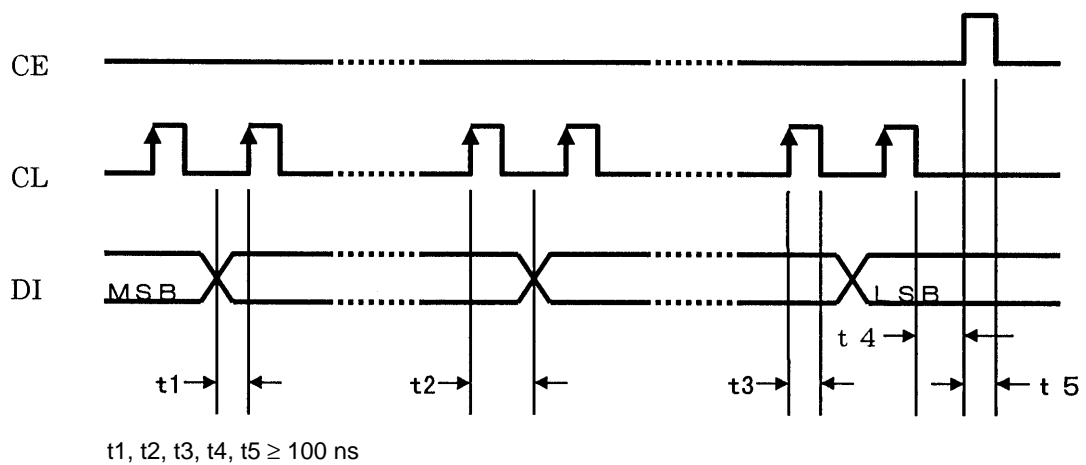


### 2. Reference Counter and Other Control

ADD latch address data must be set to 0



## Serial Data Timing



CE pin is high when the data is set to 1.  
CE pin is low when the data is set to 0.

## Data1 Byte

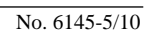
Data2 ByteData3 Byte

## 2. Reference Counter and Other Control

Data1 Byte

Data2 ByteData3 Byte

## Receiving Data Diagrams



## Serial Data Description

### (1) Programmable Counter and Test Mode

Bit "ADD(Latch Address Data)" = 1

(MSB)										(LSB)									
ADD	TS1	TS0	P16	P15	P14	P13	P12	P11	P10	P9	P8	P7	P6	P5	P4	P3	P2	P1	P0

#### 1. Programmable Counter

Bits P0 to P16 determine programmable divider ratios. Binary value with P0 as the LSB.

The division ratio can be set in the range of 4032 to 131071.

Ex. Settable division ratio factor is 8192

ADD	TS1	TS0	P16	P15	P14	P13	P12	P11	P10	P9	P8	P7	P6	P5	P4	P3	P2	P1	P0
1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0

#### 2. Test Mode

TS0 and TS1 are testing bits. These bits must normally be set to 0.

### (2) Reference Counter and Other Control

ADD is the latch address bit. This bit must be set to 0.

(MSB)										(LSB)									
ADD	CPD	ULD	UE1	UE0	PORT <sub>3</sub>	PORT <sub>2</sub>	PORT <sub>1</sub>	R11	R10	R9	R8	R7	R6	R5	R4	R3	R2	R1	R0

#### 1. Reference Counter

Bits R0 to R11 determine programmable divider ratios. Binary value with R0 as the LSB.

The division ratio can be set in the range of 20 to 4095.

Ex. Settable division ratio factor is 2048 ("\*" = Don't care)

ADD	CPD	ULD	UE1	UE0	PORT <sub>3</sub>	PORT <sub>2</sub>	PORT <sub>1</sub>	R11	R10	R9	R8	R7	R6	R5	R4	R3	R2	R1	R0
0	*	*	*	*	*	*	*	1	0	0	0	0	0	0	0	0	0	0	0

#### 2. Phase Comparator Output Control

Bit CPD is phase comparator polarity switching data.

CPD	Phase comparator polarity
0	(1) Shown Fig.1
1	(2) Shown Fig.1

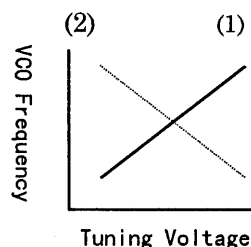


Fig.1

#### 3. Unlock Detection Control

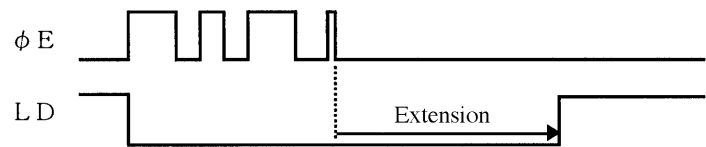
ULD is used to control the signal length which determines whether or not the PLL is locked. PLL is determined as unlocked if a phase error signal longer than that in the table below is detected.

ULD	Thresholds	fXIN = 10.24 MHz
0	$\pm 4/f_{XIN}$	390 ns
1	$\pm 8/f_{XIN}$	780 ns

4. Unlock Output Signal Extension Control

UE0 and UE1 are used to control the extension of LD signal detected in the unlock detector circuit.

UE1	UE0	Extension Time	fref = 50 k
0	0	$4 \cdot (1/\text{fref})$	80 $\mu\text{s}$
0	1	$8 \cdot (1/\text{fref})$	160 $\mu\text{s}$
1	0	$16 \cdot (1/\text{fref})$	320 $\mu\text{s}$
1	1	$32 \cdot (1/\text{fref})$	640 $\mu\text{s}$



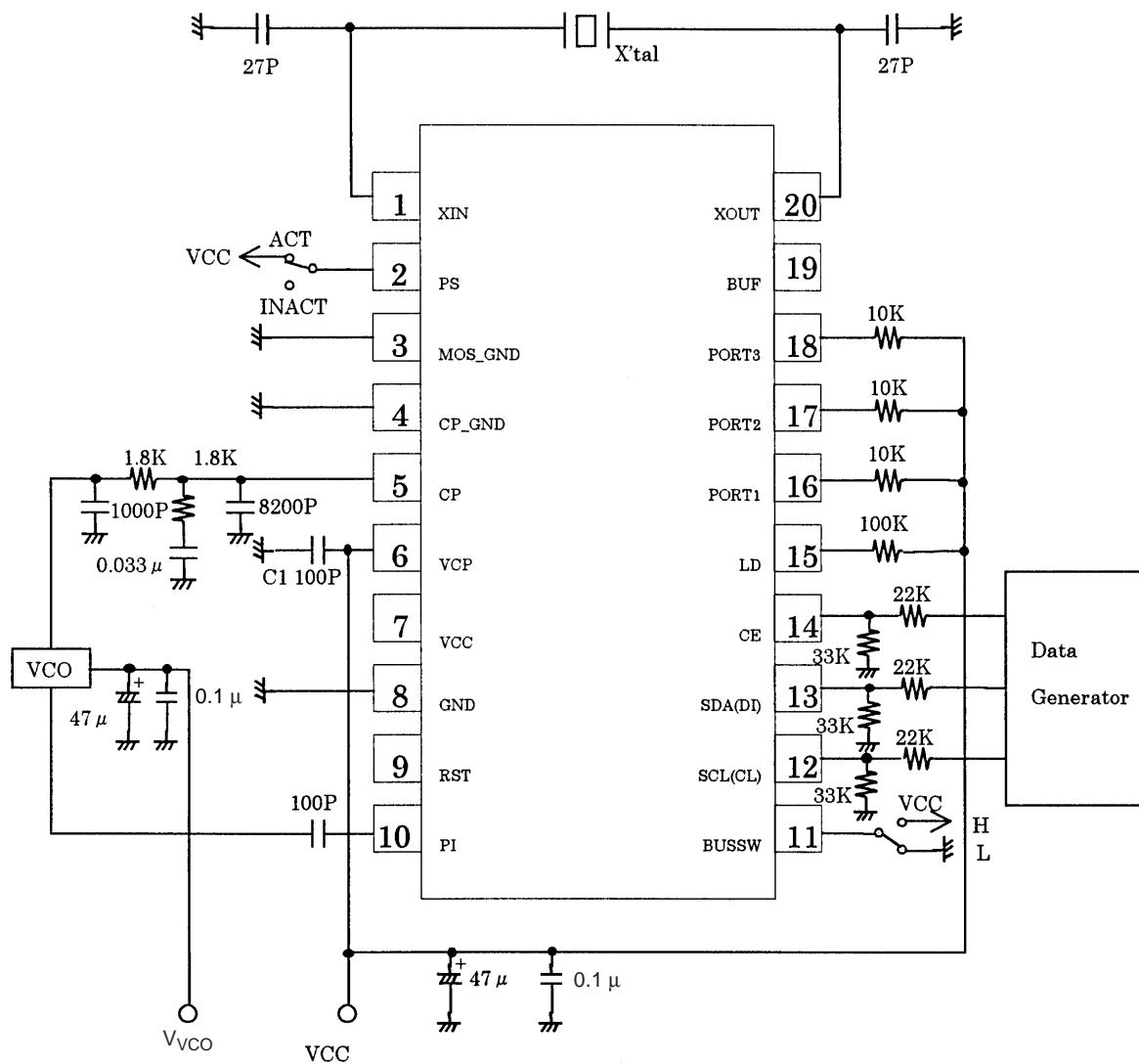
5. Band Switching Output Ports

PORT1 to PORT3 are used to switch the outputs for pin16 to pin18, respectively. The pins go to high when the data is set to 0, and go to low when set to 1.

PORT*	Output
0	High
1	Low

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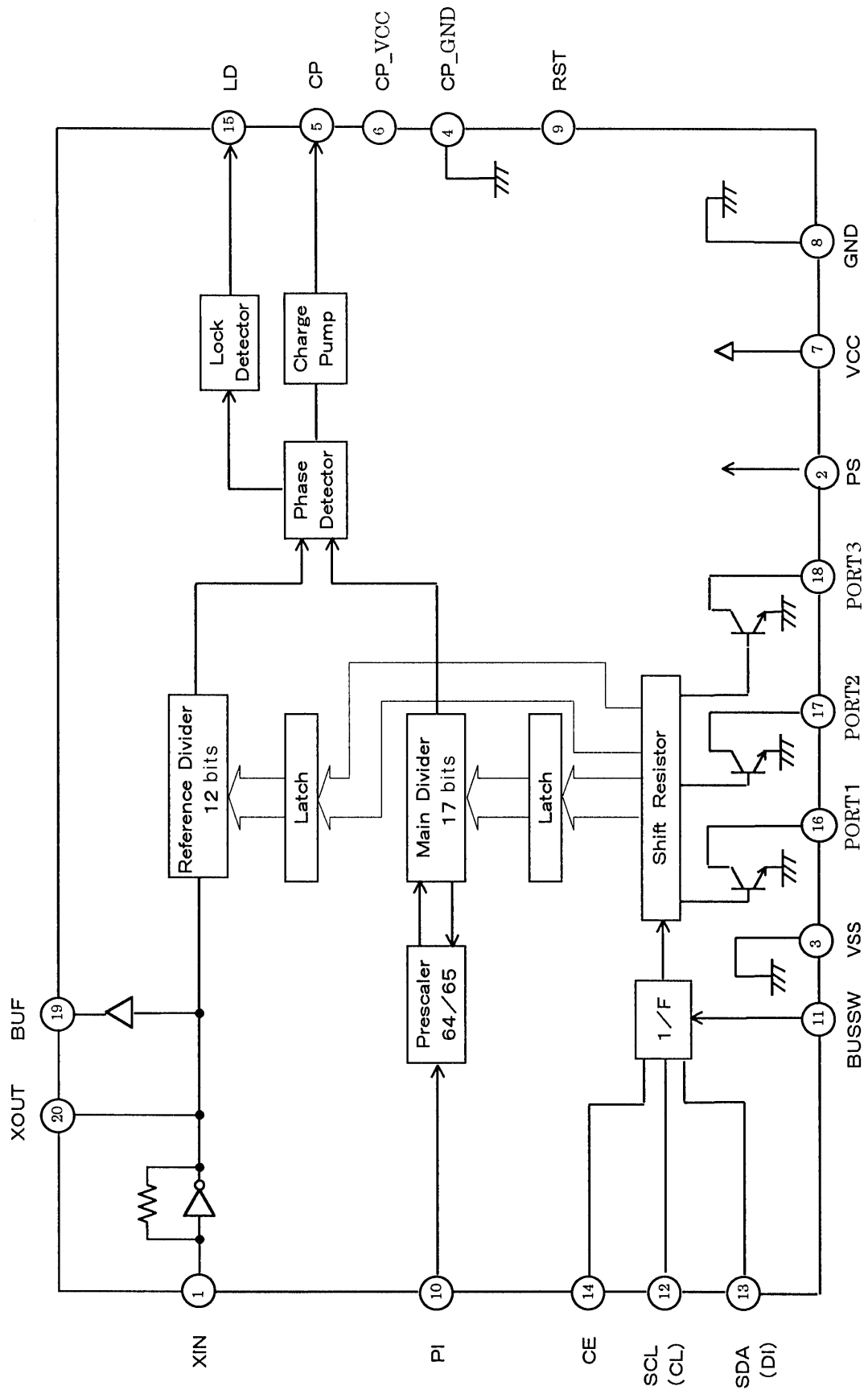
## LV2151V Evaluation Circuit



Unit (resistance: Ω, capacitance:F)



# Block Diagram



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