



## 530 MHz PLL Frequency Synthesizer LSI



### Overview

The LV2105V is a PLL frequency synthesizer Bi-CMOS LSI that provides low-voltage operation and low current drain, and that is suitable for use in a variety of radio equipment.

### Functions

- PLL function
- Data input by serial transfer (CCB format)
- Input amplifier for crystal oscillation circuit
- Data output port

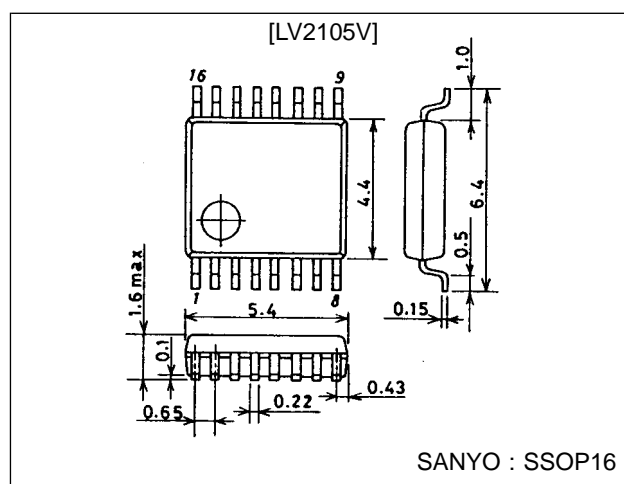
### Features

- Low operating voltage: ( $V_{CC} = 2.5$  to  $5.5$  V)
- Low current drain (5.5 mA)
- Compact package (SSOP16, 0.65 mm pitch)
- VCO band switching data output port on chip
- Data can be input while in power saving mode
- Data input pin high level can be input at  $V_{CC}$  or higher
- Independent setting of CP ON/OFF (high impedance) possible

### Package Dimensions

unit: mm

#### 3178-SSOP16



- CCB is a trademark of SANYO ELECTRIC CO., LTD.
- CCB is SANYO's original bus format and all the bus addresses are controlled by SANYO.

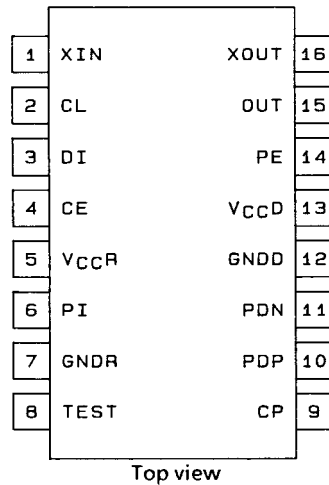
### Specifications

#### Absolute Maximum Ratings at $T_a = 25$ °C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	$V_{CC}$ max	$V_{CCR}$ , $V_{CCD}$	-0.3 to +6.0	V
Maximum input voltage	$V_{IN}$ max(1)	CE, CL, DI	-0.3 to +6.0	V
	$V_{IN}$ max(2)	XIN, TEST	-0.3 to $V_{CC}+0.3$	V
Maximum output voltage	$V_{OUT}$ max(1)	PDP	-0.3 to +9.0	V
	$V_{OUT}$ max(2)	PDN, OUT, PE	-0.3 to $V_{CC}+0.3$	V
Maximum output current	$I_{OUT}$ max	PDP	0 to +1.0	mA
Allowable power dissipation	$P_d$ max	$114 \times 76 \times 1.6$ mm <sup>3</sup> When using glass epoxy board	230	mW
Operating temperature	$T_{opr}$		-40 to +85	°C
Storage temperature	$T_{stg}$		-50 to +125	°C

# LV2105V

## Pin Assignment



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## Allowable Operating Ranges at $T_a = -40$ to $+85$ °C

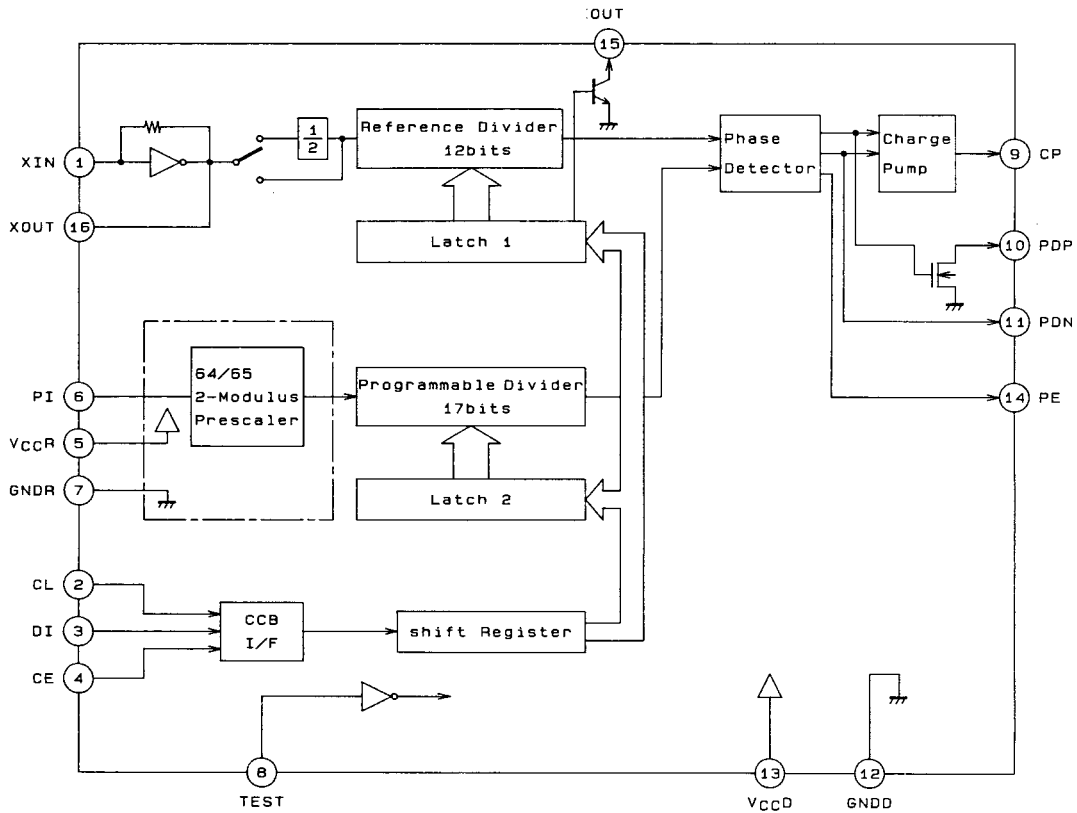
Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Supply voltage	$V_{CC}$	$V_{CCR}, V_{CCD}$	2.5		5.5	V
High-level input voltage	$V_{IH}$	CE, CL, DI	$V_{CCR} \times 0.7$		5.5	V
Low-level input voltage	$V_{IL}$	CE, CL, DI	0		+0.6	V
Output voltage	$V_{OUT}$	PDP	0		+7.0	V
Input frequency	$f_{IN}(1)$	XIN: Sine wave capacitive coupling	5		22	MHz
	$f_{IN}(2)$	PI: Sine wave capacitive coupling	100		530	MHz
Input amplitude	$V_{IN}(1)$	XIN: Sine wave capacitive coupling	-12		+10	dBm
	$V_{IN}(2)$	PI: Sine wave capacitive coupling	-18		0	dBm
Crystal oscillation condition	Xtal	XIN, (XOUT)	5		13	MHz

## Electrical Characteristics at $T_a = 25$ °C, $V_{CCR} = 3.0$ V, $V_{CCD} = 3.0$ V

Parameter	Symbol	Conditions	min	typ	max	Unit
Low-level output voltage	$V_{OL}(1)$	PDP: $I_O = 0.5$ mA			0.5	V
	$V_{OL}(2)$	PDN: $I_O = 0.5$ mA			0.5	V
	$V_{OL}(3)$	PE: $I_O = 0.5$ mA			0.5	V
	$V_{OL}(4)$	OUT: $I_O = 2.0$ mA			0.5	V
High-level output voltage	$V_{OH}(1)$	PE: $I_O = -0.5$ mA	$V_{CC} - 0.5$			V
	$V_{OH}(2)$	PDN: $I_O = -0.5$ mA	$V_{CC} - 0.5$			V
Output off leak current	$I_{OFF}(1)$	PDP: $V_O = 3.0$ V			1.0	$\mu$ A
	$I_{OFF}(2)$	CP: $V_O = 1.5$ V			100	nA
C.P output current	$I_{CP}$	CP: $V_O = 1.5$ V	$\pm 4.0$	$\pm 7.5$	$\pm 11$	mA
High-level input current	$I_H(1)$	CE, CL, DI: $V_I = 3.0$ V			5.0	$\mu$ A
	$I_H(2)$	XIN: $V_I = 3.0$ V	2.3	3.0	4.3	$\mu$ A
	$I_H(3)$	TEST: $V_I = 3.0$ V			5.0	$\mu$ A
Low-level input current	$I_L(1)$	CE, CL, DI: $V_I = 0$ V			5.0	$\mu$ A
	$I_L(2)$	XIN: $V_I = 0$ V	2.3	3.0	4.3	$\mu$ A
	$I_L(3)$	TEST: $V_I = 0$ V			5.0	$\mu$ A
Internal feedback resistance	Rf	XIN		1.0		M $\Omega$
Supply current	$I_{CC}(1)$	$V_{CCR}, V_{CCD}: *1$		5.5	9.0	mA
PS supply current	$I_{CC}(2)$	$V_{CCR}, V_{CCD}: *1$		0.4	0.6	mA

\*1: XIN = 12.8 MHz, 10 dBm, PI = 400 MHz, 0 dBm, other input pins = 0 V, output, I/O pins = OPEN CP OFF

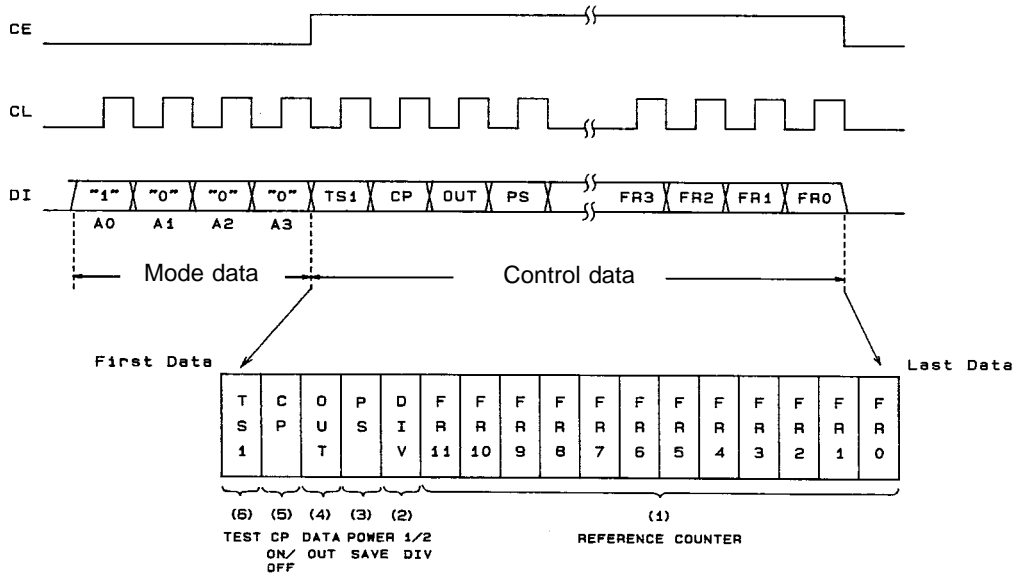
Equivalent Circuit Block Diagram



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Serial Data (PLL Control Data) Configuration

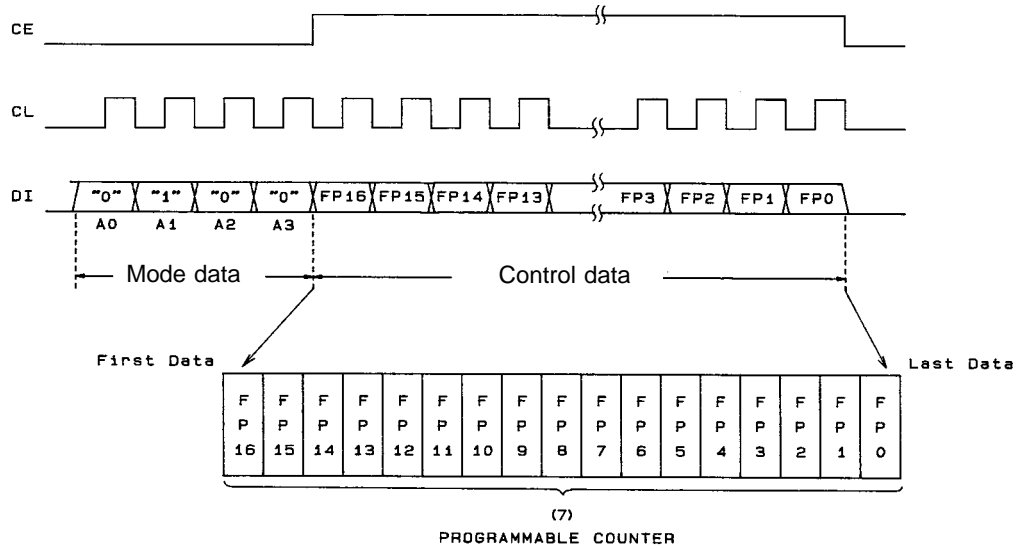
1) Mode 1: Latch-1 data (Reference divider, other data)



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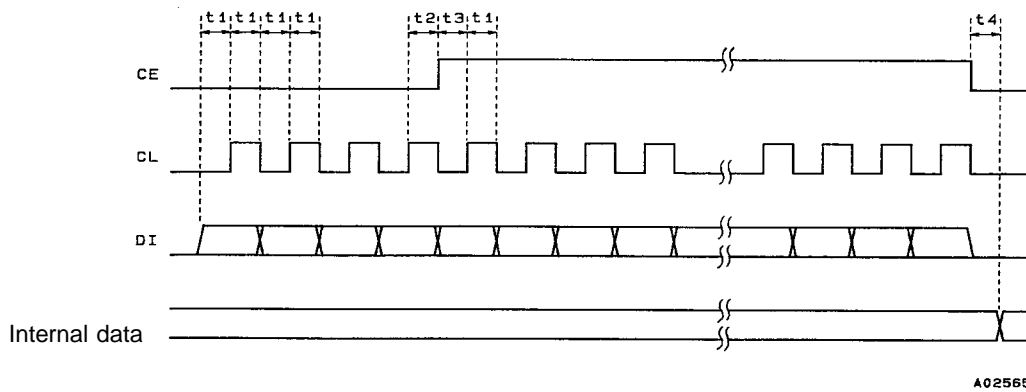
# LV2105V

## 2) Mode 2: Latch-2 data (Programmable divider data)



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## Serial Data (Transfer) Timing



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- $t_1 \geq 1.0 \mu s$
- $t_2 \geq 1.0 \mu s$
- $t_3 \geq 1.0 \mu s$
- $t_4 < 1.0 \mu s$

## Serial Data Explanation

Pin No.	Control block/data	Internal block						
(1)	Reference frequency data FR0 to FR1	<ul style="list-style-type: none"> <li>▪ Data that sets the division ratio of the reference divider. Binary value with FR0 as the LSB. However, the settable division ratio factor is up to 4095. (Actual division ratio) = (Set division ratio) (x2: when DIV is "1")</li> </ul>						
(2)	1/2 divider data DIV	<ul style="list-style-type: none"> <li>▪ Data that sets whether to use 1/2 DIV or to enter the through state.</li> </ul> <table border="1"> <thead> <tr> <th>DIV data</th> <th>Item</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Through</td> </tr> <tr> <td>1</td> <td>1/2 DIV</td> </tr> </tbody> </table>	DIV data	Item	0	Through	1	1/2 DIV
DIV data	Item							
0	Through							
1	1/2 DIV							

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## LV2105V

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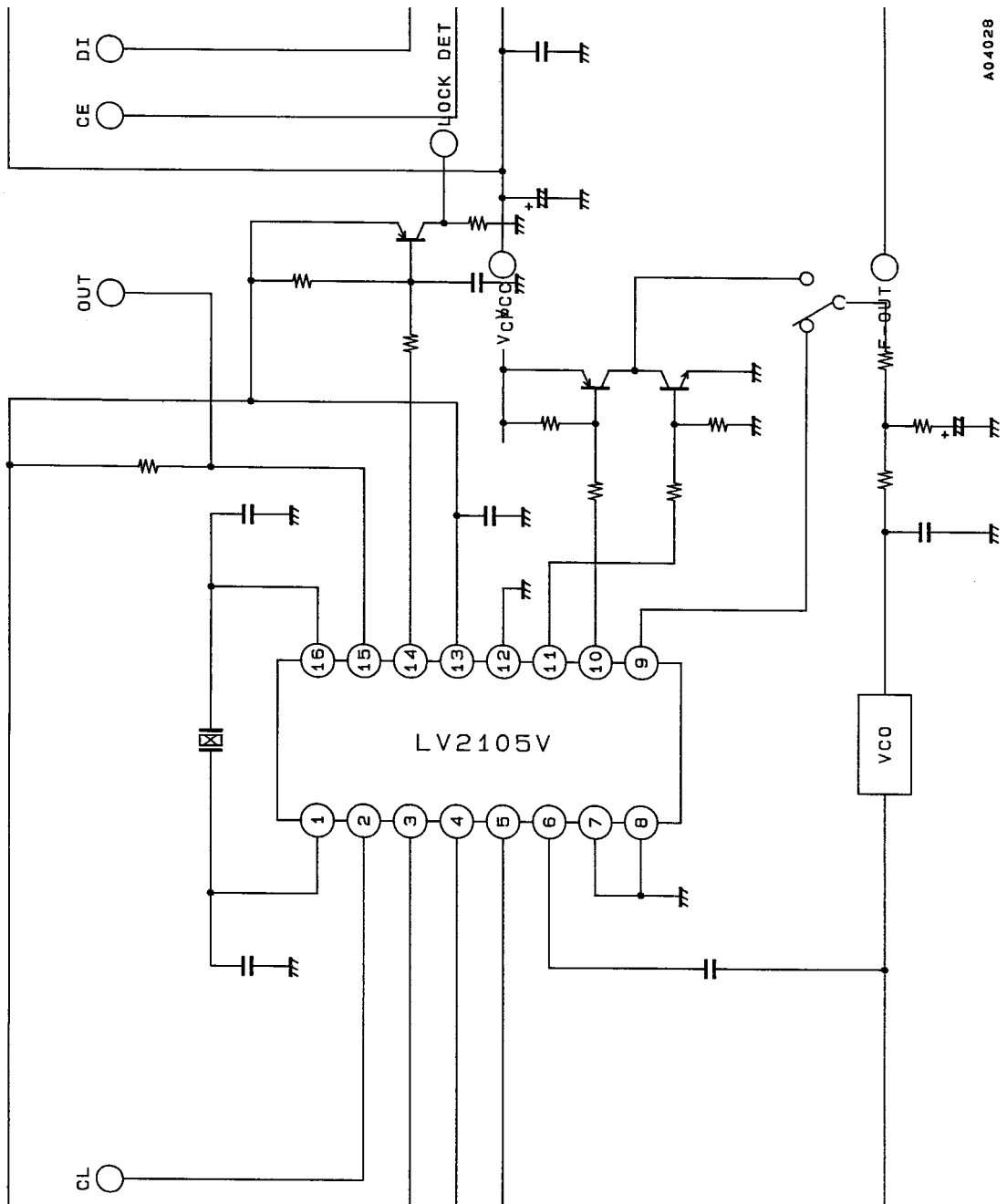
Pin No.	Control block/data	Internal block						
(3)	Power save data PS	<ul style="list-style-type: none"> <li>▪ Data that sets the power save mode on or off</li> </ul> <table border="1" style="margin-left: 20px;"> <thead> <tr> <th style="text-align: center;">PS data</th> <th style="text-align: center;">Item</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">Power save mode</td> </tr> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">Normal operation</td> </tr> </tbody> </table>	PS data	Item	0	Power save mode	1	Normal operation
PS data	Item							
0	Power save mode							
1	Normal operation							
(4)	Output port data OUT	<ul style="list-style-type: none"> <li>▪ Data that sets the output of the output port</li> </ul> <table border="1" style="margin-left: 20px;"> <thead> <tr> <th style="text-align: center;">OUT data</th> <th style="text-align: center;">OUT Pin</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">Low</td> </tr> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">High</td> </tr> </tbody> </table>	OUT data	OUT Pin	0	Low	1	High
OUT data	OUT Pin							
0	Low							
1	High							
(5)	Charge pump ON/OFF data CP	<ul style="list-style-type: none"> <li>▪ Data that sets whether to operate the charge pump or to implement high impedance.</li> </ul> <table border="1" style="margin-left: 20px;"> <thead> <tr> <th style="text-align: center;">CP data</th> <th style="text-align: center;">Item</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">High impedance</td> </tr> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">Normal operation</td> </tr> </tbody> </table>	CP data	Item	0	High impedance	1	Normal operation
CP data	Item							
0	High impedance							
1	Normal operation							
(6)	LSI test data TS1	<ul style="list-style-type: none"> <li>▪ LSI test mode switch. Set TS1 = 0. Normally, the TEST pin is connected to GND.</li> </ul>						
(7)	Programmable divider data FP0 to FP16	<ul style="list-style-type: none"> <li>▪ Data that sets the division ratio of the programmable divider. Binary value with FP0 as the LSB. However, the settable division ratio factor is up to 131071.</li> </ul>						

### Pin Functions

	Pin Name	Pin Function	I/O Style
1	XIN	Reference signal input pin (Xtal oscillation pin)	CMOS input
2	CL	Data input pin	CMOS, No pull-down
3	DI	Data input pin	CMOS, No pull-down
4	CE	Data input pin	CMOS, No pull-down
5	V <sub>CCR</sub>	ECL block power supply pin	
6	PI	Comparison signal input pin	BIP input
7	GND R	ECL block GND pin	
8	TEST	LSI test pin. Must be connected to GND.	CMOS, No pull-down
9	CP	Built-in charge pump output pin	BIP
10	PDP	Phase comparator output for an external charge pump. If not to be used, connect to GND.	CMOS, Nch open-drain output
11	PDN	Phase comparator output for an external charge pump.	CMOS output
12	GND D	GND pin for circuits except the ECL block	
13	V <sub>CCD</sub>	Power supply pin for circuits except the ECL block	
14	PE	Phase error output pin for phase comparator	CMOS output
15	OUT	Output port pin for switching external SW.	BIP NPN open-collector output
16	XOUT	Output pin for Xtal oscillation	CMOS output

# LV2105V

## Sample Application Circuit



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