MOS DIGITAL INTEGRATED CIRCUIT
μPD1701C-012

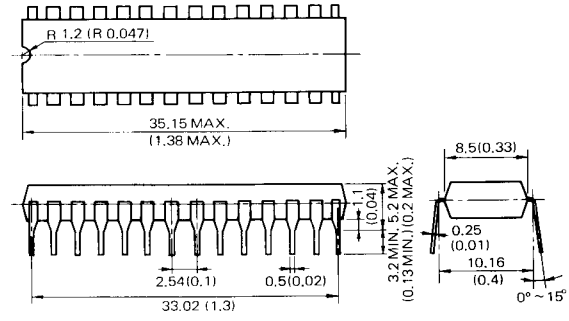
PHASE LOCKED LOOP FREQUENCY SYNTHESIZER
TV DIGITAL TUNING SYSTEM CONTROLLER
CMOS LSI

The μPD1701C-012 is a Single chip CMOS controller designed for using as a Phase Locked Loop Frequency Synthesizer Digital Tuning System Controller for TV. It consists of a PLL and system controller.

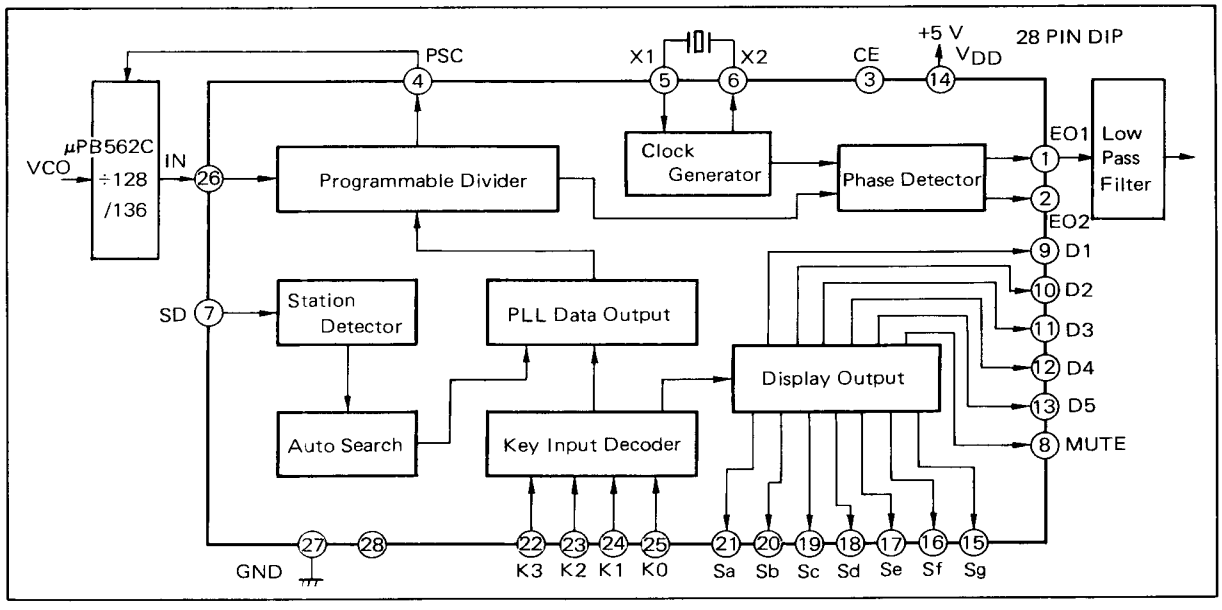
FEATURES

- PLL and Controller is realized in a single chip
- VHF/UHF/CATV in U.S. and VHF/UHF in Japan
- Direct tuning by 10 keys and automatic up or down search
- Last station memory
  TV: 1 station, CATV: 1 station (in U.S.)
- Manual fine tuning (1 step: 40 kHz ±2.52 MHz MAX.)
  Fine tuned station memory in VHF
- Function of remote control
- 28 pin slim dual in-line package (DIP)
- High speed and low power consumption due to CMOS
- Single power supply : V_{DD} = 5 ± 0.5 V

PACKAGE DIMENSIONS
in millimeters (inches)



BLOCK DIAGRAM



Nippon Electric Co.,Ltd.

ABSOLUTE MAXIMUM RATINGS

Supply Voltage	V_{DD}	−0.3 to +6.0	V
Input Voltage	V_I	−0.3 to V_{DD}	V
Output Voltage	V_O	−0.3 to V_{DD}	V
Output Current	I_{OH}	−10	mA
Storage Temperature	Tstg	−55 to +125	°C
Operating Temperature	Topt	−35 to +75	°C

ELECTRICAL CHARACTERISTICS (Ta = −35 to +75°C, V_{DD} = 4.5 to 5.5 V)

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITIONS
High Level Input Voltage	V_{IH1}	0.8V_{DD}		V_{DD}	V	SD terminal
	V_{IH2}	0.7V_{DD}		V_{DD}	V	CE terminal
	V_{IH3}	0.6V_{DD}		V_{DD}	V	K0 to K3 terminals
Low Level Input Voltage	V_{IL1}	0		0.3V_{DD}	V	CE terminal
	V_{IL2}	0		0.2V_{DD}	V	SD, K0 to K3 terminals
High Level Output Voltage	V_{OH1}	4.0			V	EO, D, MUTE: I_{OH}=−0.5 mA
	V_{OH2}	4.0			V	SEG: I_{OH}=−1.0 mA
	V_{OH3}	4.0			V	PSC: I_{OH}=−0.2 mA
Low Level Output Voltage	V_{OL1}			0.5	V	EO: I_{OL}=0.5 mA
	V_{OL2}			0.5	V	D, SEG, MUTE, PSC: I_{OL}=0.2 mA
High Level Input Current	I_{IH}	5.0	25	100	μA	K: V_I=V_{DD}=5.0 V
Frequency Response	fin	0.5		8.8	MHz	v_i=0.8 Vp-p, DC cut
Supply Voltage Rise Time	Tr			0.5	s	V_{DD}: 0 → 4.5 V
Supply Current	I_{DD}		0.5	2.0	mA	CE: Low Level

OUTLINE OF FUNCTIONS

(1) BANDS

VHF/UHF in Japan and VHF/UHF/CATV in U.S.

- Japan : 1 ch – 62 ch
- U.S. : 2 ch – 83 ch, A ch – W ch

(2) FUNCTION OF TUNING

- Direct tuning by 10 keys
- Automatic up or down search

(3) MANUAL FINE TUNING (MFT)

- 1 step : 40 kHz ± 2.52 MHz MAX
- 1 step : 125 ms
- Fine tuned station memory in VHF (Japan : 1 ch – 12 ch, U.S. : 2 ch – 13 ch)

(4) FUNCTION OF REMOTE CONTROL

- Use of the μPD1986C (transmitter) and the μPD1937C (receiver)

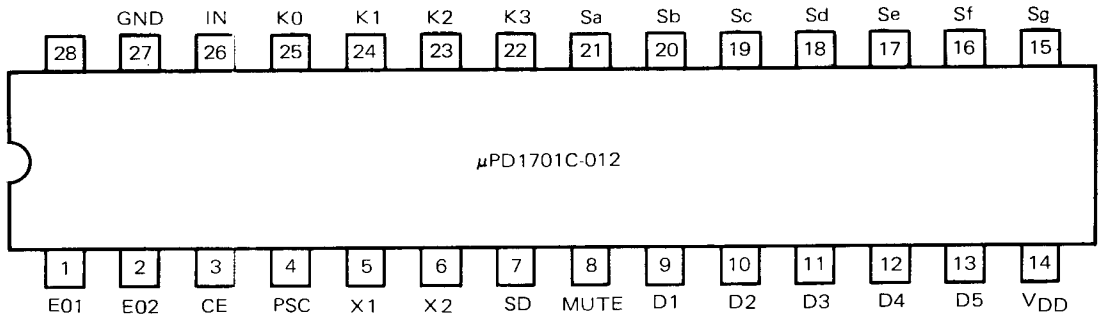
(5) DISPLAY

- Dynamic display of 3 digits (cycle : 150 Hz)

(6) REFERENCE FREQUENCY

- 5 kHz

PIN CONNECTION (Top View)



EXPLANATION OF INPUT AND OUTPUT TERMINALS

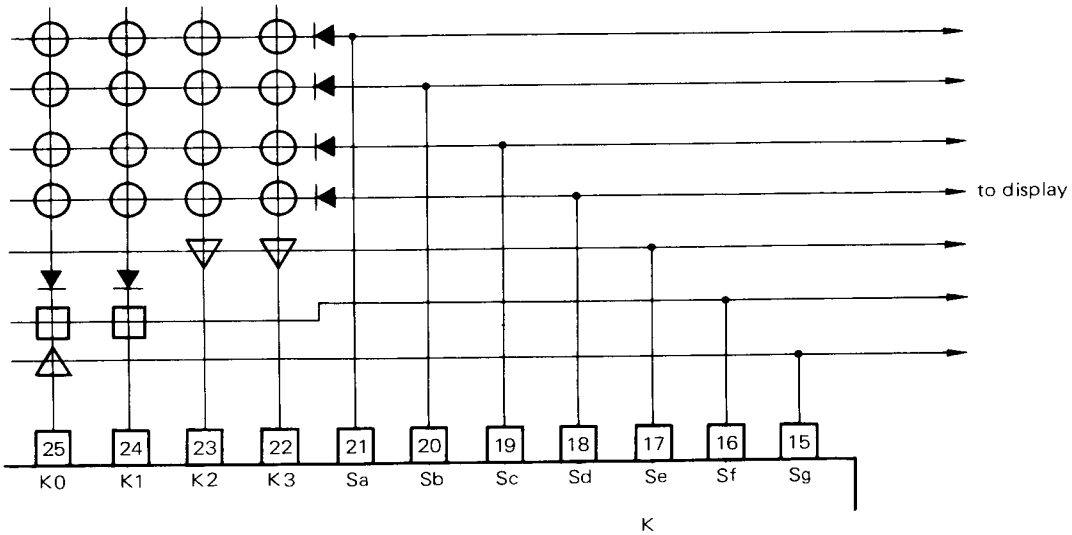
EO1 EO2	These three-state outputs are used (via active filters) to supply analog voltages to the tuner vari-cap for controlling the local osc.
CE	This input is used to designate the stand-by mode to the chip. It is low to designate the stand-by mode. (Display: off, PLL: off)
PSC	This output is used to control the division ratio of the two-modulus prescaler (μPB562C).
X1, X2	These inputs are for connection to a 4.5 MHz crystal.
SD	This input is used to control the station searching operation (CHU/CHD). It is high to indicate the presence of a station and the operation is terminated.
MUTE	This output line is high to mute the TV set in the case of station change, band change, and so on.
D1 to D5	These outputs are used as digit drivers for the display.
V_{DD}	This is a 4.5 to 5.5 volt supply for the chip.
Sa to Sg	These outputs are used as segment drivers for the display. They are also used as vertical drive for the control key and mode switch matrix.
K0 to K3	These inputs are from seven by four matrix. Various functions are entered through the matrix. These inputs are provided with internal pull down resistors.
IN	This is the local oscillator input.
GND	System ground.

* Please keep 28 pin open because it is pulled up internally.

COMPOSITION OF KEYS

	K3 (22)	K2 (23)	K1 (24)	K0 (25)	
Sa (21)		2	3	CLR	momentary key switch
Sb (20)	4	5	6	FTU	
Sc (19)	7	8	9	FTD	
Sd (18)	CHD	0	CHU	FTR	
Se (17)	RCD	RCU			transistor switch
Sf (16)			POW	CATV/TV	alternate switch
Sg (15)				JAP/US	diode

CONNECTION TO THE MATRIX OF KEYS

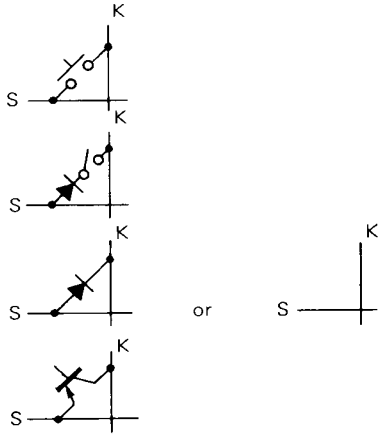


momentary key switch

alternate switch

diode

transistor



EXPLANATION OF CONTROL KEYS

- **0 – 9 (10 keys)** — These keys are used for direct tuning. Each station is tuned by using two keys within them (EX, 8 ch : 0, 8, 12 ch : 1, 2). If a second key is not depressed within 5 seconds from when a first key was depressed, a first key is cancelled.
- **CLR (Clear)** — This key is used for cancelling a first key when a wrong key (within 10 keys) is depressed first (EX. 8 ch : 8, CLR, 0, 8).
- **FTU, FTD (Fine Tuning Up) (Fine Tuning Down)** — These keys are used for manual fine tuning. While these keys are depressed, tuning frequency increases (or decreases) by 40 kHz at every 125 ms. The range is ±2.52 MHz. In VHF band, fine tuning condition can be memorized at each channel. In UHF band, it returns to each initial condition when other channels are selected.
- **CHU, CHD (Channel Up) (Channel Down)** — These keys are used for automatic up (or down) search. While these keys are depressed, tuning frequency increases (or decreases) to the next station at every 750 ms. Interval time can be shortened by repeating the depression of them.
- **FTR (Fine Tuning Reset)** — This key is used for resetting fine tuning condition of a current channel.

EXPLANATION OF MODE SWITCHES

- POW (Power) — This switch is used with a main switch of a TV set. While this is on, all keys and switches can be used. While this is off, any keys and switches except this can not be used.
- CATV/TV (Band Switch) — This switch is used for selecting CATV or TV band in U.S. While this is on, VHF and CATV bands are selected. While this is off, VHF and UHF bands are selected.

EXPLANATION OF A DIODE

JAP/US	AREA	BANDS
off	U.S.	VHF : 2 ch – 13 ch (55.25 – 211.25 MHz) UHF : 14 ch – 83 ch (471.25 – 885.25 MHz) CATV : A ch – W ch (121.25 – 169.25 MHz) (217.25 – 295.25 MHz)
on	Japan	VHF : 1 ch – 12 ch (91.25 – 217.25 MHz) UHF : 13 ch – 62 ch (471.25 – 765.25 MHz)

* RELATION BETWEEN CATV CHANNEL AND INPUT CHANNEL NUMBER

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36

EXPLANATION OF BAND SIGNAL OUTPUTS

Band signals are out from three segment outputs (Sa, Sb and Sc) when D_5 is on.

	Sa	Sb	Sc
Low ch in VHF	H	L	L
High ch in VHF	L	H	L
UHF	L	L	H

H : high level, L : low level

EXPLANATION OF REMOTE CONTROL SYSTEM

The μPD1701C-012 can be remotely controlled by using the μPD1986C (transmitter) and the μPD1937C (receiver).

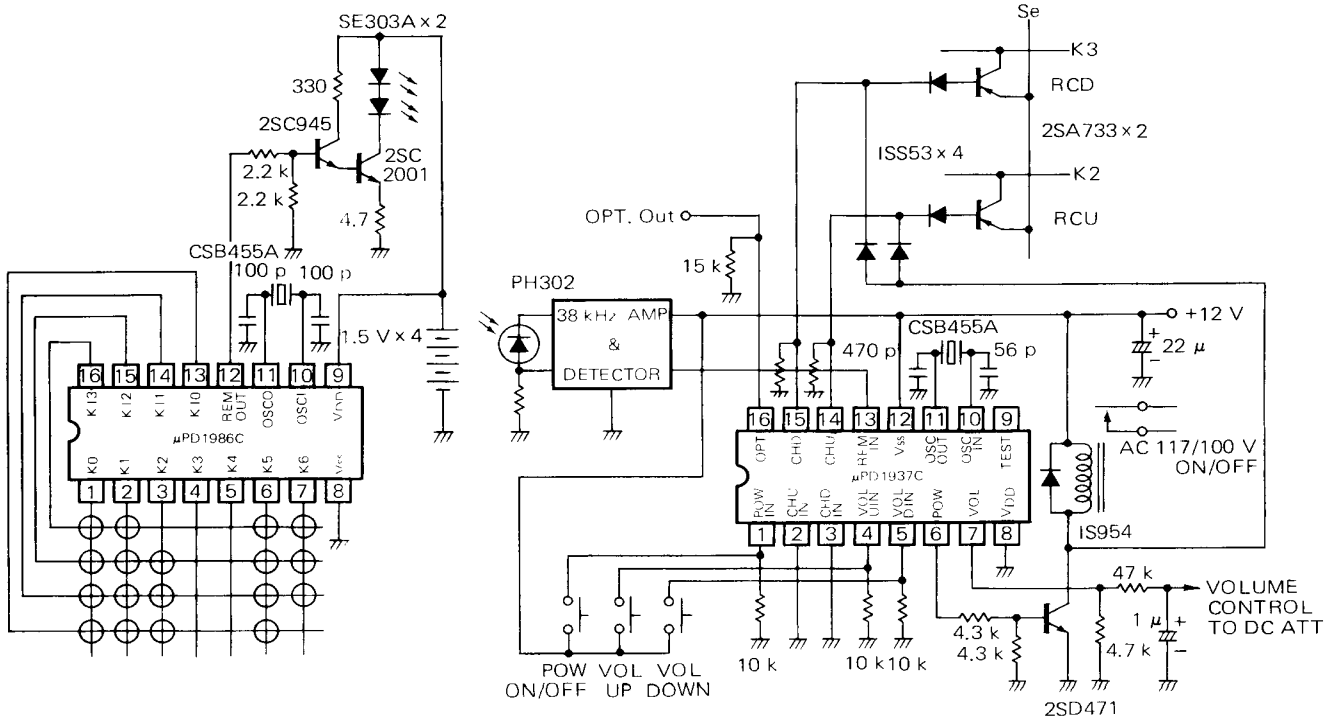
* OUTLINE OF FUNCTIONS

- Direct tuning by 10 keys
- Automatic up or down search
- Function of clear (CLR)
- Power on/off
- Muting on/off
- Volume up/down (32 steps)
- One option

* COMPOSITION OF KEYS AT THE μPD1986C

	KI3 (16)	KI2 (15)	KI1 (14)	KI0 (13)
K0 (1)	3	2	1	0
K1 (2)	7	6	5	4
K2 (3)		CLR	9	8
K3 (4)				
K4 (5)				
K5 (6)	CHU	CHD	VOLU	VOLD
K6 (7)	POW	OPT	MUTE	

APPLICATION OF REMOTE CONTROL SYSTEM



APPLICATION CIRCUIT