NEC
ELECTRON DEVICE

MOS DIGITAL INTEGRATED CIRCUIT
μPD1703C-017

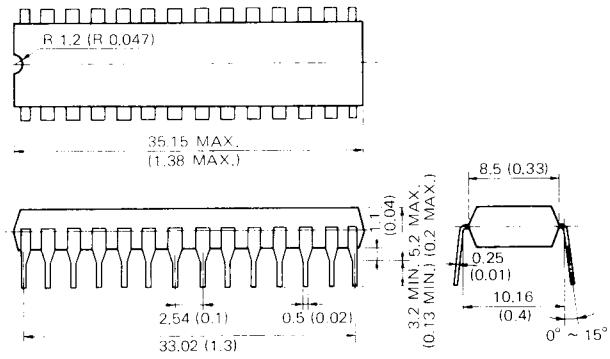
PHASE LOCKED LOOP FREQUENCY SYNTHESIZER
TV DIGITAL TUNING SYSTEM CONTROLLER
CMOS LSI

The μPD1703C-017 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.

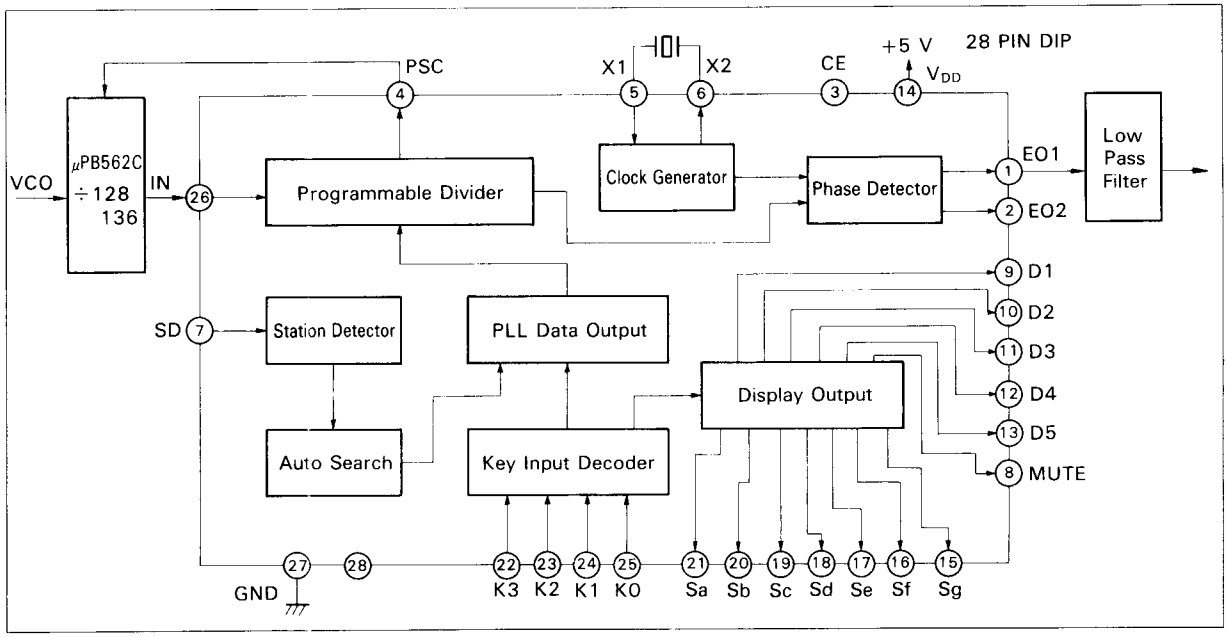
FEATURES

- PLL and Controller is rea ized in a single chip
- Pulse Swallowing Method using the μPB562C
- VHF/UHF/CATV in U.S. and CANADA
- Direct tuning by 10 keys and automatic up or down search
- Last station memory
  TV: 1 station, CATV: 1 station (M/S . . . off)
- Manual fine tuning (1 step: 40 kHz ±2 MHz MAX.)
  Fine tuned station memory in VHF and CATV
- 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
- Low stand-by current . . . . . less than 10 μA(CE . . . low)

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 Breakdown Voltage *	V_{BDS}	-35	V
Output Current	I_{OH}	-10	mA
Storage Temperature	Tstg	-55 to +125	°C
Operation Temperature	Topt	-35 to +75	°C

*: Segment Output Terminals (P-ch open drain)

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

CHARACTERISTICS	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}	3.0			V	SEG: I_{OH}=-0.5 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,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	vi=0.8 Vp-p, DC cut
Supply Voltage Rise Time	Tr			0.5	s	V_{DD}: 0 → 4.5 V
Supply Current	I_{DD}			10	μA	CE: Low Level
Output Off Leak Current	I_{OFF}			-5.0	μA	SEG: V_{DS}=-30 V

OUTLINE OF FUNCTIONS

(1) BANDS

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

- M/S . . . off

  VHF : 2 ch – 13 ch
  UHF : 14 ch – 83 ch
  CATV : A ch – W ch

- M/S . . . on

  VHF : 2 ch – 13 ch
  UHF : 14 ch – 83 ch
  CATV : A ch – I 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 MHz MAX
- Fine tuned station memory in VHF and CATV

  M/S: on . . . VHF (2 ch – 13 ch) and mid-band (A ch – I ch)
  M/S: off . . . mid-band and super-band (A ch – W ch)

(4) AUTO FINE TUNING (AFT)

- 1 step: 40 kHz ± 2 MHz MAX
- 1 cycle: 5 ms

(5) FUNCTION OF REMOTE CONTROL

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

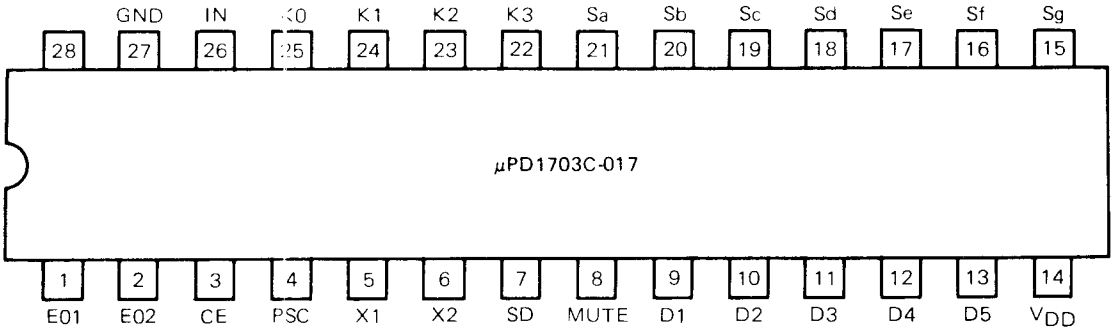
(6) DISPLAY

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

(7) REFERENCE FREQUENCY

- 5 kHz

PIN CONNECTION (Top View)



EXPLANATION OF INPUT AND OUTPUT TERMINALS

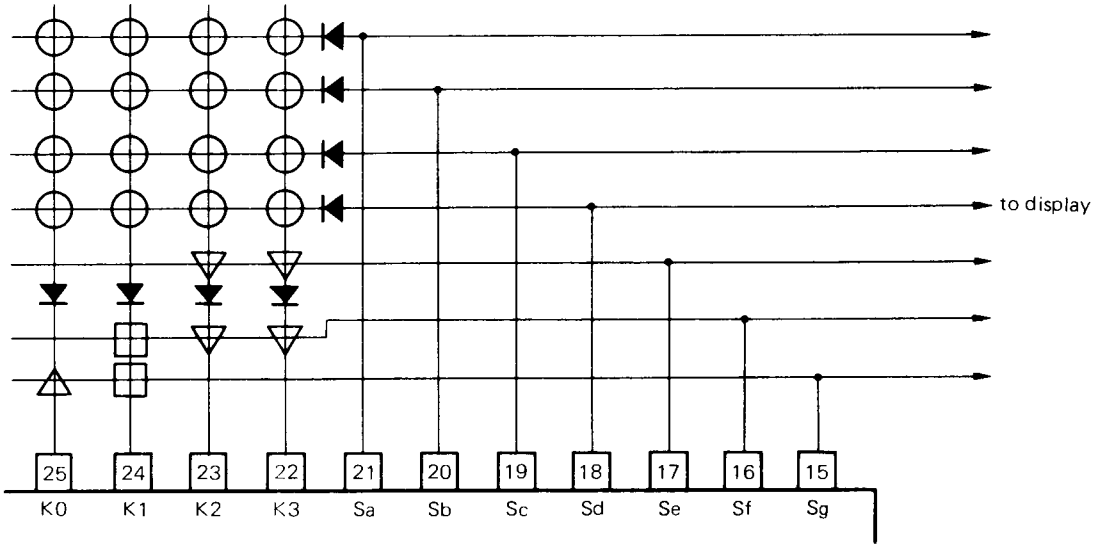
EO1 EO2	These three-state outputs are used (via active filters) to supply analog voltages to the tuner varicap for controlling the local osc.
CE	This input is used to designate the stand-by mode to the chip. It is low to designate the stand-by mode (display: off, PLL: off, system clock: stop).
PSC	This 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)	1	2	3	CLR
Sb (20)	4	5	6	FTU
Sc (19)	7	8	9	FTD
Sd (18)	CHD	0	CHU	FTR
Se (17)	RCD	RCU		
Sf (16)	AFTD	AFTU	AFT	
Sg (15)			CATV/TV	M/S

CONNECTION TO THE MATRIX OF KEYS

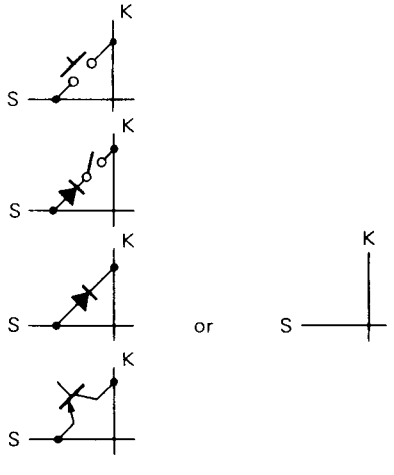


momentary key switch

alternate switch

diode

transistor



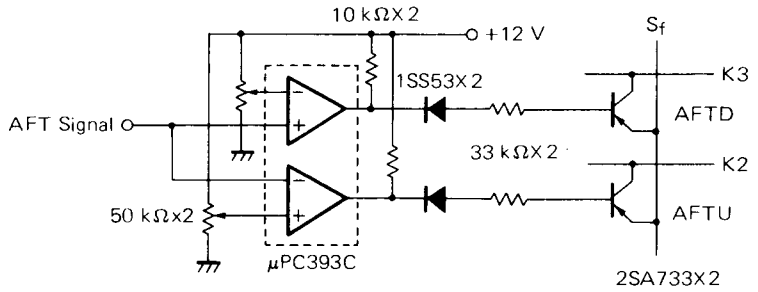
EXPLANATION OF CONTROL KEYS

- 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 4 seconds from when a first key was depressed, a first key is cancelled. If wrong ch is selected, the μPD1703C-017 shows the error.
- 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 MHz. In VHF and CATV bands (M/S: off . . . mid-band and super band, M/S: on . . . VHF band and mid band), fine tuning condition can be memorized at each channel (1 step: 320 kHz). 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 depressing of them.
- FTR (Fine Tuning Reset) — This key is used for resetting fine tuning condition of a current channel.

EXPLANATION OF MODE SWITCHES

- AFT (Auto Fine Tuning) — This switch is used for selecting the mode of fine tuning. While this is on, AFT is effective but MFT is ineffective. In this case, frequency changes automatically by 40 kHz according to the external AFT signal. While this is off, AFT is ineffective but MFT is effective.
- CATV/TV (Band Switch) — This switch is used for selecting CATV or TV band. While this is on, VHF and CATV bands are selected. While this is off, VHF and UHF bands are selected.

APPLICATION OF AFT



* Please keep the time constant of AFT signal less than 5 ms.

EXPLANATION OF A DIODE

M/S	FUNCTION
off	VHF and UHF or mid-band and super-band can be tuned with CATV/TV switch.
on	VHF, UHF and mid-band can be tuned without CATV/TV switch.

* RELATION BETWEEN CATV CHANNEL AND INPUT CHANNEL NUMBER

●M/S : off

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

●M/S : on

A	B	C	D	E	F	G	H	I
84	85	86	87	88	89	90	91	92

EXPLANATION OF BAND SIGNAL OUTPUTS

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

segment / band	Sa	Sb	Sc	Sd
VL	H	L	L	L
VH,MB	L	H	L	L
SB	L	H	L	H
UB	L	L	H	L

H: high level, L: low level

EXPLANATION OF REMOTE CONTROL SYSTEM

The μPD1703C-017 can be remotely controlled by using the μPD1986C (transmitter) and the μPD1937C (receiver).

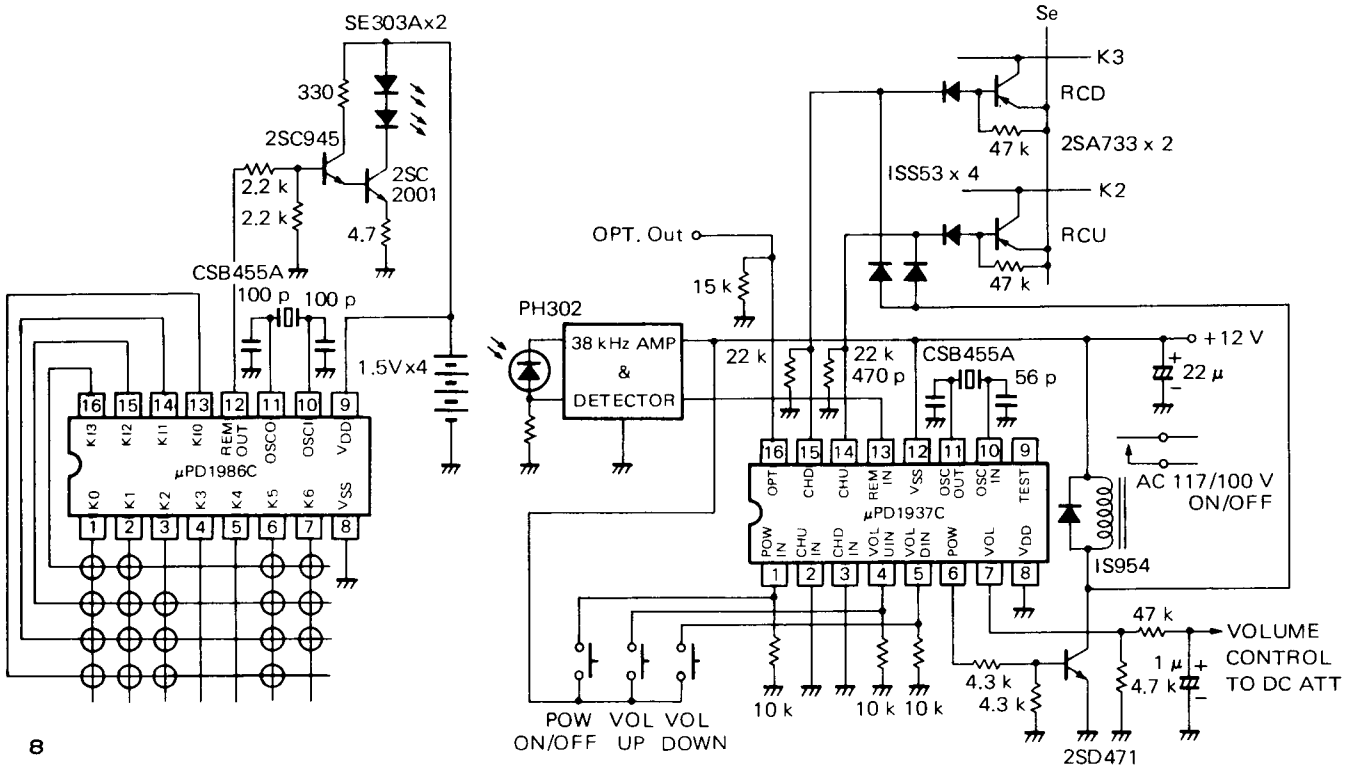
* OUTLINE OF FUNCTIONS

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

* COMPOSITION OF KEYS AT THE μPD1986C

	K13 (16)	K12 (15)	K11 (14)	K10 (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