HOLTEK

HT6P50

Hopping Code Learning Decoder

Features

- Operating voltage: 2.4V~5.2V
- Rolling code decoder
- Low power and high noise immunity of CMOS technology
- Pair with HOLTEK's rolling encoders (HT6P60)
- Learning function
- Selectable two or four times' check for output
- Four-time check for learning mode
- Anti-scan pause
- 150ms break time for successive learning
- Re-synchronized by 2 valid transmission in 3s
- Receiving data bit rate: 1KHz typically
- VT goes high during a valid receiving
- Easy interface with an RF or Infra-Red receiver
- Selectable latch or momentary type data output
- 8 sets of customer code at maximum can be stored
- 16/18/20 DIP or SOP

Applications

- Burglar alarm system
- Smoke and fire alarm system
- Garage door controllers
- Car door controllers
- Car alarm system
- Security system
- Cordless telephones
- Other remote control systems

General Description

The HT6P50 rolling decoder, paired with the HT6P60 rolling encoder, is a CMOS LSI for remote control system applications. It is connected with an external EEPROM (of the HT93LC46), providing rolling and learning capability. During learning mode, after decoding and 4 times' verification the customer code, transmitted from the encoder is extracted and stored in EEPROM. A maximum of 8 sets of customer code can be stored in EEPROM.

The serial information is transmitted by a carrier using an RF or IR transmission medium. In the remote control mode, the received code will be decoded and compared with the local customer code in EEPROM. If both codes are the same and the received rolling address is greater than the EEPROM address pointer by 6, the data pin (one of the D0~D7) turns out to be active. In addition, the VT pin goes high and the external LED turn on indicating a valid receiving.

There are two kinds of output to be selected on the data pins, namely latch and momentary, and it is also selectable for 2 or 4 times data verification (checking).

The IC provides three types of packages for various data output numbers (4/6/8 data output).

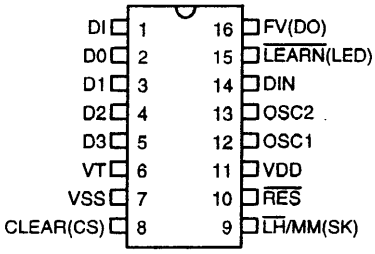
Check Time Option Table

FV(DO) Pin	Check Times
Pull-high or disconnect	4
Connect a pull-down resistor	2

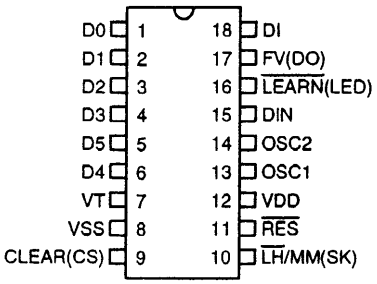
Notes: 1. "2 check times" denotes that a valid receiving is active after 2 frames are received and verified.

2. "4 check times" denotes that a valid receiving is active after 4 frames are received and verified.

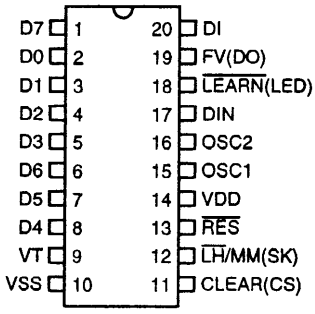
Pin Assignment



HT6P50
– 16 DIP/SOP

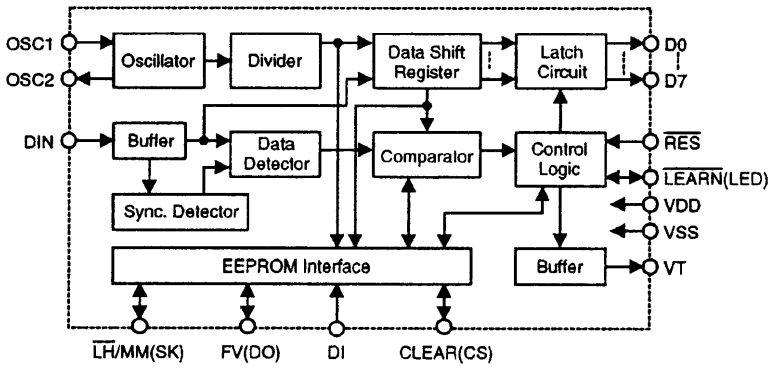


HT6P50
– 18 DIP/SOP

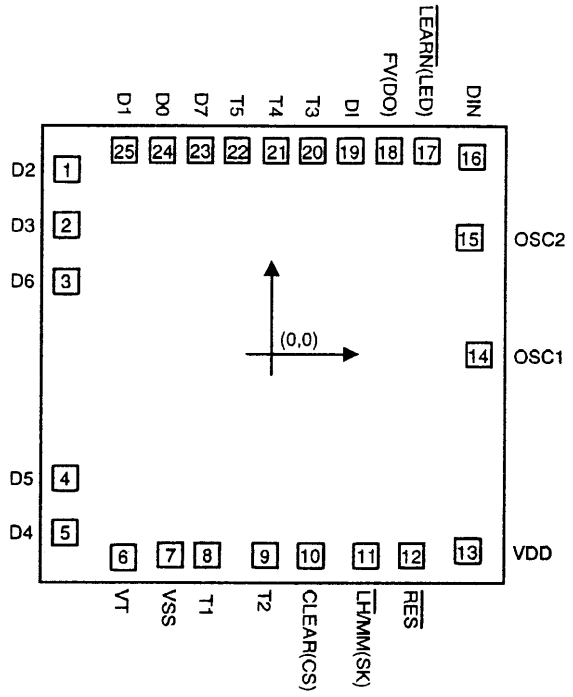


HT6P50
– 20 DIP/SOP

Block Diagram



Pad Coordinates



Chip size: 2400 × 2500 $(\mu m)^2$

* The IC substrate should be connected to VSS in the PCB layout artwork.
* The T2 pad must be bonded to VDD or VSS.
* The T1~T5 pads for IC test only.

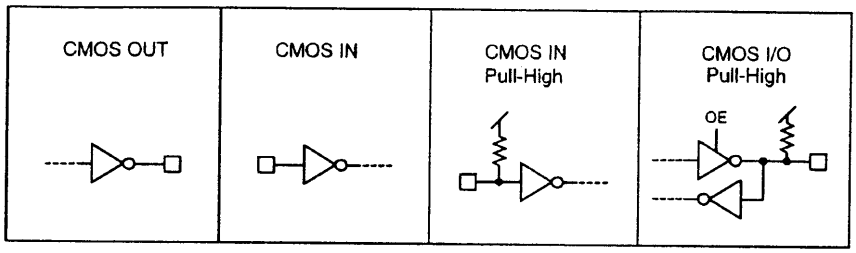
Unit: μm

Pad No.	X	Y	Pad No.	X	Y
1	-1034.40	914.20	14	1034.40	1.20
2	-1034.40	641.00	15	985.00	583.30
3	-1034.40	360.20	16	993.20	980.40
4	-1034.40	-620.30	17	769.90	1010.4
5	-1034.40	-893.30	18	582.50	1010.4
6	-739.00	-1014.40	19	390.60	1010.4
7	-503.40	-1001.30	20	198.50	1010.4
8	-318.40	-1001.60	21	16.00	1010.4
9	-27.40	-1001.60	22	-180.80	1010.4
10	201.6	-1003.60	23	-363.30	1010.4
11	476.2	-1003.60	24	-555.40	1010.4
12	704.6	-1001.60	25	-747.30	1010.4
13	984.4	-977.50			

Pin Description

Pin Name	I/O	Internal Connection	Description
DI	I	CMOS IN Pull-High	Input the data from EEPROM (connected to EEPROM DO pin)
D0~D7	O	CMOS OUT	Output data pins, active high
VT	O	CMOS OUT	Valid receiving indication, active high
VSS	I	—	Negative power supply (GND)
CLEAR(CS)	I/O	CMOS I/O	Input: Data in EEPROM are all erased when the CLEAR(CS) pin is turned high and $\overline{\text{LEARN}}$(LED) pin is turned low more than 1 seconds or if the CLEAR(CS) pin is turned high more than 1 seconds at the learning mode. Output: The EEPROM chip selection signal output (connected to EEPROM CS pin)
$\overline{\text{LH}}$/MM(SK)	I/O	CMOS I/O Pull-High	Input: Data output type selection. The type has to be set before power is turned on or the system is reset. $\overline{\text{LH}}$/MM(SK) is disconnected: The data output is of the momentary type. $\overline{\text{LH}}$/MM(SK) is connected to VSS: The data output is of the latch type. Output: Serial clock output for EEPROM (connected to EEPROM SK pin)
$\overline{\text{RES}}$	I	CMOS IN	Input for resetting the chip inside, active low
VDD	I	—	Positive power supply
OSC1	I	—	Oscillator input pin Connect to an external oscillation resistor.
OSC2	O	—	Oscillator output pin, $f_{OSC}/4$ frequency output
DIN	I	CMOS IN	Serial information input pin from the RF or IR receiver
$\overline{\text{LEARN}}$(LED)	I/O	CMOS I/O Pull-High	Input: To set the chip into the learning mode, or to erase all EEPROM data when the $\overline{\text{LEARN}}$(LED) pin is used with the CLEAR(CS) pin; active low Output: To sink the LED current for status indication
FV(DO)	I/O	CMOS I/O Pull-High	Input: To decide the customer code's check times in remote control mode. Refer to the functional description. Output: To active the LED for status indication, refer to the functional description This pin is also used to output the received information to EEPROM (Connected to EEPROM DI pin)

Approximate internal connection circuits



Absolute Maximum Ratings

Supply Voltage ..... −0.3V to 5.5V
Input Voltage..... V_{SS}−0.3V to V_{DD}+0.3V
Storage Temperature..... −50°C to 125°C
Operating Temperature..... −20°C to 75°C

Electrical Characteristics

(Ta=25°C)

Symbol	Parameter	Test Condition		Min.	Typ.	Max.	Unit
		V_{DD}	Condition				
V_{DD}	Operating Voltage	—	—	2.4	—	5.2	V
I_{DD}	Operating Current	5V	No load, F_{OSC}=2MHz	—	1	2	mA
I_{OH1}	Data Output Source Current (D0~D7)	5V	V_{OH}=4.5V	−2	−3	—	mA
I_{OH2}	$\overline{LH}$/MM(SK) Pin Source Current	5V	V_{OH}=4.5V	−2	−3	—	mA
I_{OH3}	FV (DO) Pin Source Current	5V	V_{OH}=4.5V	−2	−3	—	mA
I_{OH4}	VT Pin Source Current	5V	V_{OH}=4.5V	−2	−3	—	mA
I_{OL1}	Data Output Sink Current (D0~D7)	5V	V_{OL}=0.5V	4	6	—	mA
I_{OL2}	$\overline{LH}$/MM (SK) Pin Sink Current	5V	V_{OL}=0.5V	4	6	—	mA
I_{OL3}	FV (DO) Pin Sink Current	5V	V_{OL}=0.5V	4	6	—	mA
I_{OL4}	VT Pin Sink Current	5V	V_{OL}=0.5V	4	6	—	mA
V_{IH}	"H" Input Voltage	5V	—	3.5	—	V_{DD}	V
V_{IL}	"L" Input Voltage	5V	—	0	—	1.0	V
R_{PH}	DI, $\overline{LH}$/MM(CS), $\overline{LEARN}$(LED), FV(DO), Pins Pull-High Resistance	5V	V_{IN}=0V	10	30	50	KΩ
T_{KEY}	LEARN and CLEAR Key Debounce Time	—	F_{OSC}=2MHz	—	20	—	ms
F_{OSC}	Oscillator Frequency	5V	R_{OSC}=180KΩ	—	2	—	MHz

Functional Description

The HT6P50 is a rolling decoder for remote control system applications. It can interface with HOLTEK's EEPROM (HT93LC46) to store a maximum of 8 sets of customer code. The LSI provides three kinds of packages for various data output numbers.

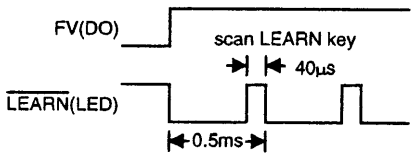
Package Form	Data No
16 DIP/SOP	4
18 DIP/SOP	6
20 DIP/SOP	8

Operation

The HT6P50 checks the customer code data in the EEPROM after power up. If any customer code exist the decoder enters the "remote control mode" for receiving signals from the DIN pin. On the other hand, if none of the customer codes exist, the HT6P50 enters the "waiting mode" instead.

Waiting mode

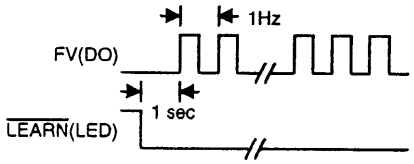
In the waiting mode, the oscillator is activated to set the FV(DO) pin high and let the $\overline{\text{LEARN}}$(LED) pin outputs a scanning signal to indicate the EEPROM is empty and performing the LEARN key scanning. The waveform is shown in the following diagram where 40μs positive pulses are used to scan the state of the $\overline{\text{LEARN}}$(LED) pin. Once a valid LEARN key trigger signal is received, it goes to the learning mode.



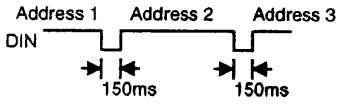
Waiting mode LED Timing

Learning mode

The HT6P50 goes into the learning mode from the waiting mode or idle state if the $\overline{\text{LEARN}}$(LED) pin is active low more than 1 seconds. Then the FV(DO) pin will output a flash signal at a 1Hz rate until a set of customer codes is learned within 10 seconds. During the 10 seconds, if the DIN pin receives proper formatted information and no mistakes are made after 8 times' check, the received customer code will be stored in EEPROM and the FV(DO) pin will stop flashing and the $\overline{\text{LEARN}}$(LED) pin will turn high. After a customer code is acquired, the learning mode is terminated and the system enters the idle state. In contrast, during the 10 seconds if no proper formatted information is input, the FV(DO) pin will stop flashing and the LSI returns to its original mode right after time is up. The HT6P50 can save a maximum of 8 sets of customer codes in EEPROM. Once the 8 sets of customer codes are saved, the HT6P50 cannot enter the learning mode any more unless EEPROM's customer codes are all erased. During the learning mode, D0~D7 and VT output pins are held low.



Learning mode LED Timing



Sussessive learning timing

EEPROM erase function

All the data in EEPROM are erased when the CLEAR(CS) pin is active high and $\overline{\text{LEARN}}$(LED) pin is active low more than 1 seconds or if the CLEAR(CS) pin is active high more than 1 seconds in the learning mode. The FV(DO) pin will be automatically output high and the $\overline{\text{LEARN}}$(LED) will turn low once the EEPROM's data are erased.

Idle state

When EEPROM has stored one or more sets of customer codes, the LSI enters the idle state. In the idle state, the LSI is ready for receiving information from the paired encoders to trigger the DIN pin or pressing the LEARN key enters the learning mode. The EEPROM data can be erased by pressing both LEARN and CLEAR keys (refer to the Application Circuit).

Remote control mode

After one or more sets of local customer code have been stored in the EEPROM, the HT6P50 is ready to receive information transmitted by an encoder. The received information are decoded to exfract the a customer code, and then compares it with one of the local codes in the EEPROM. If the received rolling address is synchronous (see the synchronous operation) and 2 or 4 successively received customer codes (decided by the FV(DO) pin state) correspond to the contents of one of the EEPROM's local customer codes, the data code is decoded to the D0~D3 pins. At this time, the VT pin is output high and the FV(DO) pin is output high and the $\overline{\text{LEARN}}$(LED) pin is output low to indicate valid receiving.

Output type

- Data pin output type

  The initial D0~D7 and VT pins are all at low level when power is turned on. After D0~D7 and VT pins are activated by a valid receiving in the remote control mode, two types of D0~D7 pins outputs, namely momentary and latch types, can be selected and decided by the $\overline{\text{LH}}$/MM (SK) pin.

  * Momentary type

    The $\overline{\text{LH}}$/MM(SK) pin is disconnected

    The data outputs follow the encoder only during a valid receiving.

  * Latch type

    The $\overline{\text{LH}}$/MM(SK) pin is turned low

    The data outputs follow the encoder during a valid receiving and are latched in this state until the next valid receiving occurs.

$\overline{\text{LH}}$/MM(SK) Pin	Data Pin Output Type
Pull-High or Disconnect	Momentary
Connect a Pull-Down Resistor	Latch

If the logic status of $\overline{\text{LH}}$/MM or FV pins are changed (see the Application Circuit), the RESET key has to be pressed or power has to be switched off and on again or the EEPROM has to be completely erased. Otherwise, the change is invalid.

- VT pin output type

  The VT pin outputs a high_level signal for indicating a valid receiving in the remote control mode. If the valid receiving ceases, it remains high and then turns low after 100ms.

- FV(DO) and $\overline{\text{LEARN}}$(LED) pins output type

  The following three status are indicated by the FV(DO) and $\overline{\text{LEARN}}$(LED) pins:

  * System in the waiting mode

    In the waiting mode, the FV(DO) pin outputs high and the $\overline{\text{LEARN}}$(LED) pin outputs low if no data is saved in EEPROM. However, the FV(DO) pin outputs low when there are data saved in EEPROM.

  * System in the remote control mode

    The FV(DO) pin outputs high and the $\overline{\text{LEARN}}$(LED) pin outputs low for indicating a valid receiving.

  * System in the learning mode

    In the learning mode, the FV(DO) pin flashes with 1Hz 10 seconds at maximum, and the $\overline{\text{LEARN}}$(LED) pin outputs a low_level signal. Refer to the learning mode operation.

- Anti-scan

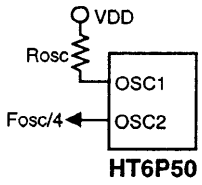
  The HT6P50 possesses an anti-scan function which pauses the decoder for an illegal data with an approximate format is detected.

Synchronous operation

In the remote control mode, if the rolling code is properly received, and the received rolling address is not greater than the EEPROM address pointer of the decoder by 6, the encoder and the decoder can be regarded as synchronous. The address pointer of the decoder will update its contents to be the same as that of the received rolling address. On the other hand, if the received rolling address is greater than the internal address pointer of the decoder by 6, the encoder and decoder are looked upon as asynchronous and the remote control operation is invalid. To synchronize them, two consecutive rolling addresses have to be received and no errors are detected by the decoder within an interval of 3 seconds. That is to say, the data pin of the encoder has to be triggered twice consecutively within 3 seconds to resynchronize the decoder with encoder.

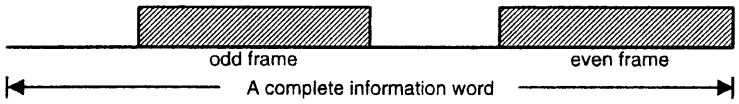
Oscillator

The HT6P50 has a built-in oscillator which works with an external oscillation resistor only. The following diagram shows the way that the circuit is connected.

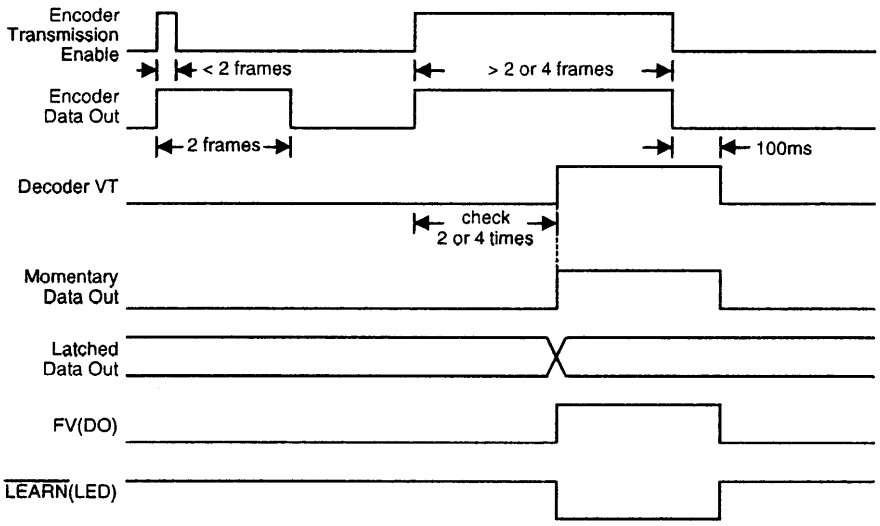


Information word diagram

A complete information word is made up of 2 frames (an odd frame & an even frame) of information. Each information word consists of period bit, synchronize bit, data code, address code and customer code.



Decoder timing diagram



Operation flowchart