# HT6P20
# $2^{24}$ OTP Encoder

## Features

- Operating voltage: 2V~12V
- Low power consumption
- Built-in oscillator needs only 5% resistor
- 0/2/4/8 data selectable
- $2^{24}$ maximum address and data codes
- Easy interface with an RF or IR medium
- One time programmable process
- Data active: D0~D7
- Minimal external components

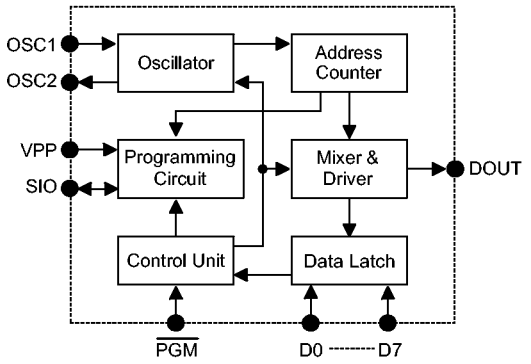
## Applications

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

## General Description

The HT6P20 is a CMOS LSI encoder designed for remote control system applications. It encodes 24 bits of information and then serially transmits it via the DOUT pin upon receipt of transmission enable (DATA pins: D0~D7) signals. The combination of address and data bits of the HT6P20 is designed using one time programmable process. In addition, the chip offers various packaging for flexible combination of programmable address/data so as to meet various applications. Its programmable address/data is transmitted together with the anti-code bits via RF or infrared transmission medium upon receipt of a trigger signal.

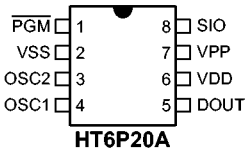
## Block Diagram




Note: Address/Data numbers are available in various combinations, refer to the functional description.

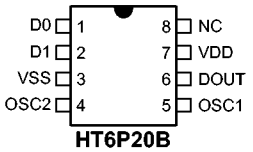
## Pin Assignment

**24-Address 0-Data**



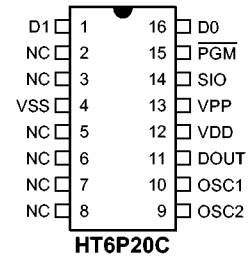

**HT6P20A – 8 DIP/NSOP**

**22-Address 2-Data**



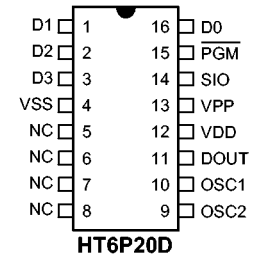

**HT6P20B – 8 DIP/NSOP**

**22-Address 2-Data**



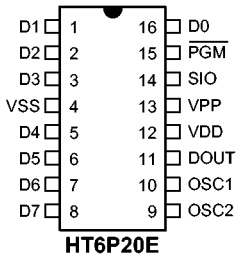

**HT6P20C – 16 DIP/NSOP**

**20-Address 4-Data**



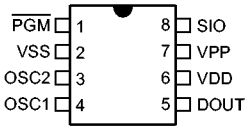

**HT6P20D – 16 DIP/NSOP**

**16-Address 8-Data**



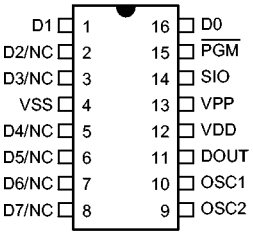

**HT6P20E – 16 DIP/NSOP**

**Blank device**




**HT6P20 – 8 DIP/NSOP**

**Blank device**




**HT6P20 – 16 DIP/NSOP**

Notes: The customer code and control code have been programmed into HT6P20A/B/C/D/E by Holtek's factory process.

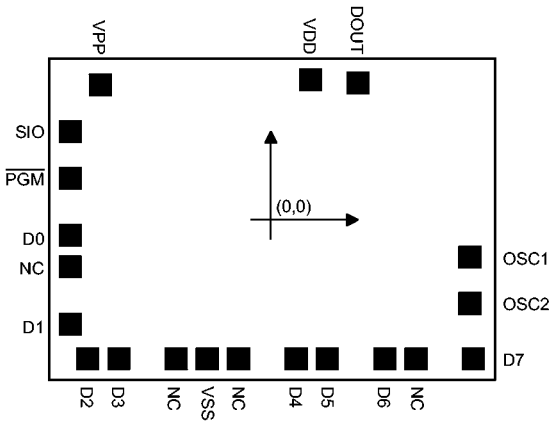
The blank device HT6P20 is not programmed, it can be programmed by Holtek's programming kit.

Warning: The 8-pin blank device only allows programming as HT6P20A type.

The 16-pin blank device allows programming as one of HT6P20C/D/E type. After programming the HT6P20 pin name are the same as one of HT6P20C/D/E, which is determined by the kit programming procedure.

Pin name "NC" stands for no connection (floating).

## Pad Assignment




Chip size: 2590 × 2010 $(\mu m)^2$

* The IC substrate should be connected to VSS in the PCB layout artwork.

## Pad Coordinates

Unit: μm

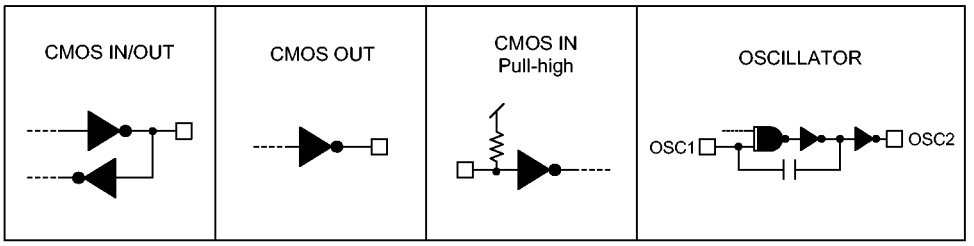
| Pad No. | X | Y |
|---|---|---|
| 1 | −956.50 | 762.75 |
| 2 | −1123.00 | 498.75 |
| 3 | −1123.00 | 236.25 |
| 4 | −1123.00 | −86.25 |
| 5 | −1123.00 | −261.25 |
| 6 | −1123.00 | −583.75 |
| 7 | −1027.50 | −776.75 |
| 8 | −852.50 | −776.75 |
| 9 | −530.00 | −776.75 |
| 10 | −355.00 | −776.75 |
| 11 | −180.00 | −776.75 |
| 12 | 142.50 | −776.75 |
| 13 | 317.50 | −776.75 |
| 14 | 640.00 | −776.75 |
| 15 | 815.00 | −776.75 |
| 16 | 1137.50 | −776.75 |
| 17 | 1118.00 | −466.75 |
| 18 | 1118.00 | −205.75 |
| 19 | 489.00 | 772.05 |
| 20 | 223.50 | 789.75 |

## Pin Description

### HT6P20E

| Pin No. | Pin Name | I/O | Internal Connection | Description |
|---|---|---|---|---|
| 16<br>1~3 | D0~D3 | I | CMOS IN<br>Pull-high | Data input and transmission enable (active low)<br>They can be externally set to VSS or left open. |
| 4 | VSS | I | — | Negative power supply (GND) |
| 5~8 | D4~D7 | I | CMOS IN<br>Pull-high | Data input and transmission enable (active low)<br>They can be externally set to VSS or left open. |
| 9 | OSC2 | O | OSCILLATOR | Oscillator output pin |
| 10 | OSC1 | I | OSCILLATOR | Oscillator input pin |
| 11 | DOUT | O | CMOS OUT | Data serial transmission output |
| 12 | VDD | I | — | Positive power supply |
| 13 | VPP | I | — | Programming power supply, $V_{DD}$ for normal operation |
| 14 | SIO | I/O | CMOS<br>IN/OUT | Programming address/control code input and mode code output for mode verification |
| 15 | $\overline{PGM}$ | I | CMOS IN<br>Pull-high | Program mode control pin, active low |

### Approximate internal connection circuits




## Absolute Maximum Ratings

Supply Voltage .....–0.3V to 12V
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

Note: These are stress ratings only. Stresses exceeding the range specified under "Absolute Maximum Ratings" may cause substantial damage to the device. Functional operation of this device at other conditions beyond those listed in the specification is not implied and prolonged exposure to extreme conditions may affect device reliability.

## Electrical Characteristics

Ta=25°C

| Symbol | Parameter | | Test Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|---|
| | | | $V_{DD}$ | Conditions | | | | |
| $V_{DD}$ | Operating Voltage | | — | — | 2 | — | 12 | V |
| $I_{STB}$ | Standby Current | | 12V | Oscillator stops | — | 1 | 2 | μA |
| $I_{DD}$ | Operating Current | | 12V | No load $f_{OSC}$=3kHz | — | 200 | 400 | μA |
| $V_{IH}$ | "H" Input Voltage | | — | — | 0.8$V_{DD}$ | — | $V_{DD}$ | V |
| $V_{IL}$ | "L" Input Voltage | | — | — | 0 | — | 0.2$V_{DD}$ | V |
| $R_{PH}$ | D0~D7 Pull-high Resistance | | 12V | — | — | 150 | 300 | kΩ |
| $I_{DOUT}$ | Output Current | Source | 5V | 0.9$V_{DD}$ | –2 | –5 | — | mA |
| | | | 12V | 0.9$V_{DD}$ | –6.5 | –15 | — | mA |
| | | Sink | 5V | 0.1$V_{DD}$ | 2 | 5 | — | mA |
| | | | 12V | 0.1$V_{DD}$ | 6 | 15 | — | mA |
| $f_{OSC}$ | Oscillator Frequency | | 12V | $R_{OSC}$=1.4MΩ | — | 3 | — | kHz |

## Functional Description

### Programming

The HT6P20 is a one time programmable encoding integrated circuit. The programmable codes consist of 4-bit control codes and 24-bit address codes. Before using the device, first program the internal 4 control bits and 24 address bits. Then, to program the address and control codes, connect the $\overline{PGM}$ pin to VSS, allowing the SIO pin to receive control and address codes from the continuously transmitting programming kit. The control codes (B0~B3) and address timing are respectively shown on the Table and the Figure for Programming Timing. In the programming process, the mode bit (B0) has to be programmed first. The 0/2/4/8 data number is selected by the address along with the data format bits (B1,B2). The HT6P20, in addition, provides a polarity bit (B3) to select the polarity of the output data.

Various packages of the HT6P20 offer programmable combinations of address/data to meet various application needs.

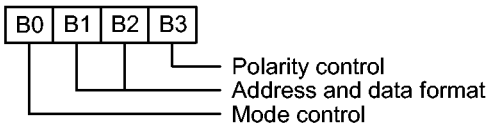



**Table 1: Control code**

- Mode control (B0)

| B0 | Function |
|---|---|
| 0 | Not programmed |
| 1 | Programmed |

- Address and data format (B1,B2)

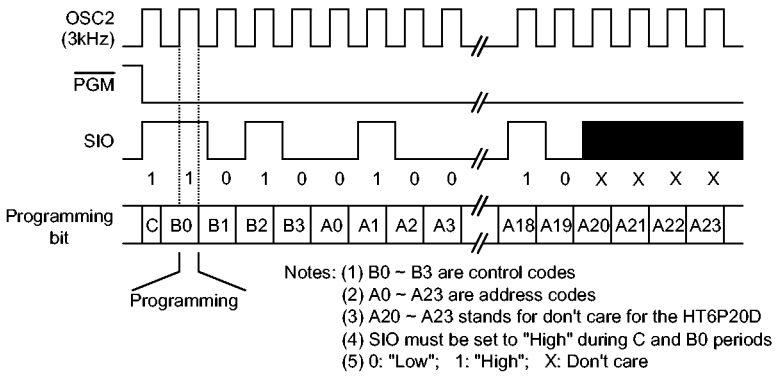
| B2 | B1 | Code Format |
|---|---|---|
| 0 | 0 | A0~A23 |
| 0 | 1 | A0~A21 + D1~D0 |
| 1 | 0 | A0~A19 + D3~D0 |
| 1 | 1 | A0~A15 + D7~D0 |

- Polarity control (B3)

| B3 | Data Output Polarity |
|---|---|
| 0 | Negative polarity |
| 1 | Positive polarity |

The HT6P20A/C/D/E can be programmed by the SIO pins. The HT6P20B, on the other hand, is programmed for 2-data and positive polarity application.

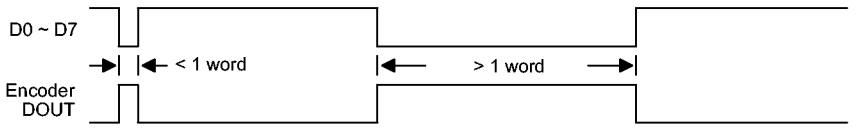
### Programming timing of the HT6P20D (B0~B3=1010)




Programming timing for the HT6P20D

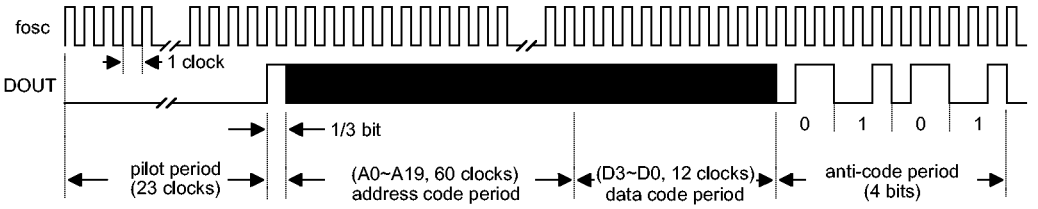
### Normal operation

The HT6P20 encodes and transmits address/data to a decoder upon receipt of a trigger signal. The address codes of the HT6P20A are always transmitted as long as power (VDD) is supplied. The transmission function of the HT6P20B/C/D/E is enabled by the D0~D7 pins (active low). The following is the transmission timing of the HT6P20:



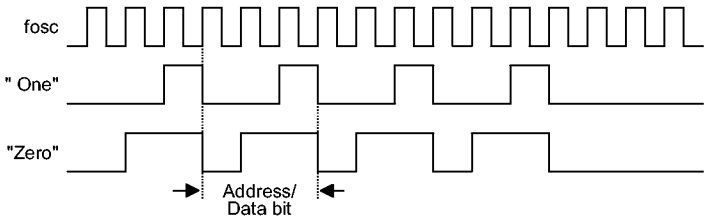

Transmission timing

A complete code word of the HT6P20D consists of 3 periods as shown below.

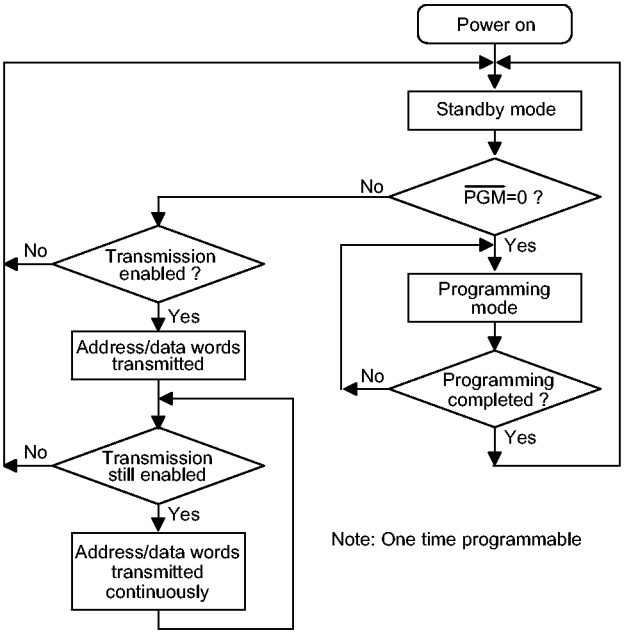



A complete code word for the HT6P20D

The HT6P20A/B/C/D/E detects the logic state of the internal programmed address and the external data pins, and then transmits the detected information during the code period. Each address/data bit can be set to one of the following two logic states:

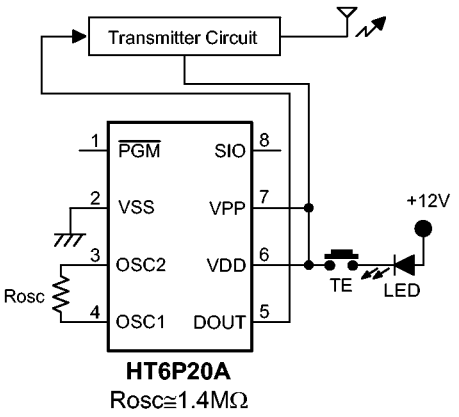


### Flowchart

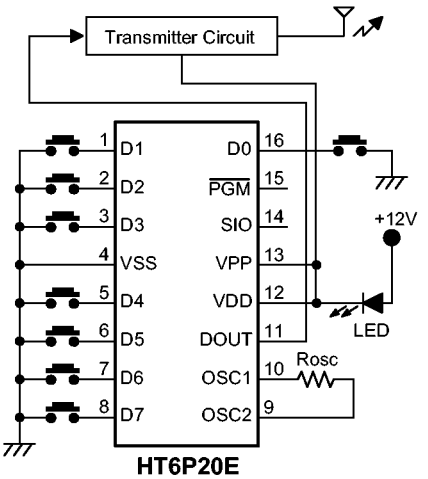



Note: One time programmable

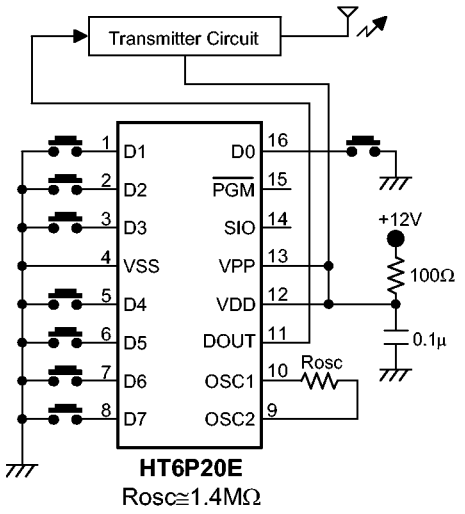
## Application Circuits

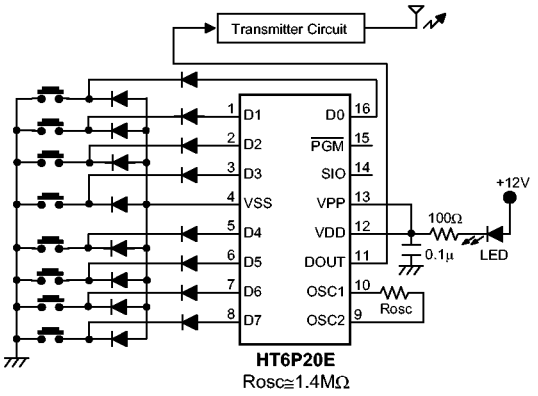


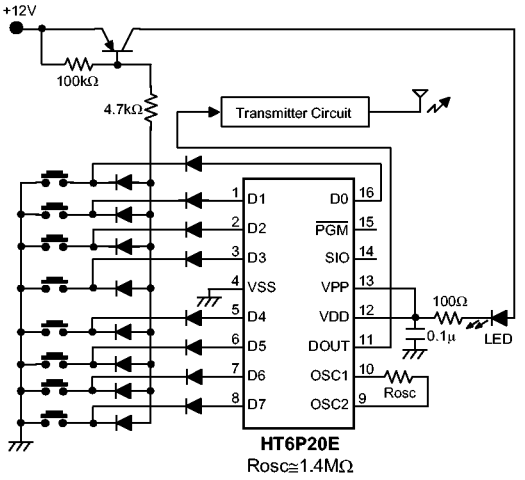

**HT6P20A**
Rosc≅1.4MΩ




**HT6P20E**
Rosc≅1.4MΩ




Note: In order to prevent the IC from getting damaged due to the latch up, the 100Ω resistor or the LED which can also be a transmission indicator is indispensible when $V_{DD}$=9V~12V.