HT6P11
2^{24} Learning Decoder

Features

- Operating voltage: 2.4V~5.2V
- Low power and high noise immunity CMOS technology
- Capable of decoding 24-bit information
- Pair with HOLTEK's 2^{24} programmable encoders (HT6P20)
- 0/2/4 bit data selectable by M0 and M1 pins
- Binary address setting
- Anti-scan pause
- 100ms break time for successive learning
- Three times of check for remote control
- Five times of check for Learning State
- Built-in oscillator needs only 5% resistor
- VT goes high during a valid transmission
- Easy interface with RF or infrared receiver
- Minimal external components

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 HT6P11 2^{24} decoder is a CMOS LSI for remote control system applications. It pairs with HOLTEK's 2^{24} series of programmable encoders.

The combination of HT6P11 & EEPROM (HT93LC46) offers the learning function. The EEPROM is capable of storing a maximum of 8 sets of local address. When in learning state, the chip decode & undone the serial addresses received from a 2^{24} encoder as its own local customer code (address) and store them in the EEPROM after completing 5 times of verification.

On the other hand, it compares the local addresses twice with the received codes when in the remote control state, if all matched, the received data codes are decoded to output pins and the VT goes high to indicate a valid transmission.

The HT6P11 is capable of decoding 24 bits of information which consists of address of N bits and data of (24–N) bits. It is arranged to provide a number of data bits ranging from 0 to 4 and an address bit ranging from 20 to 24 to meet various applications, with the selection made by controlling the status of M0 & M1 pins (refer to the data selection table).

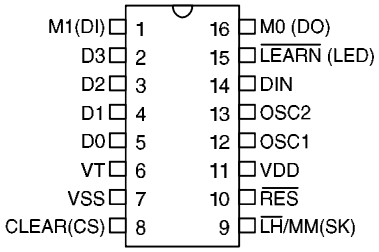
Data Selection Table

Mode	Status		Address No.	Data No.	VT
	M0	M1			
Mode 0	0	0	24	0	√
Mode 1	1	0	22	2	√
Mode 2	X	1	20	4	√

Note: The VT can be used as a momentary data output.

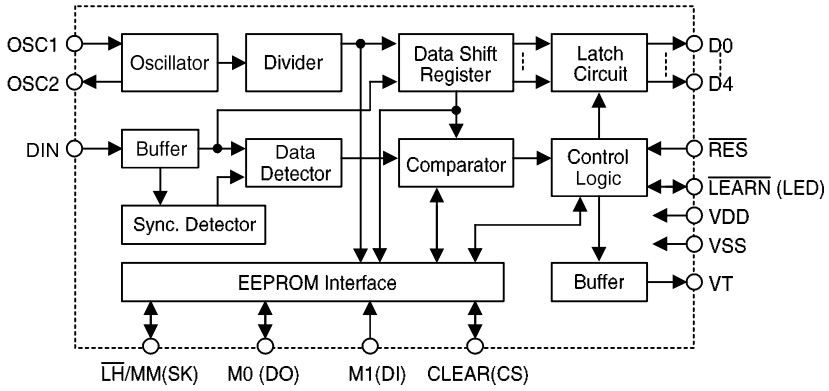
0 : Connect a pull-down resistor
1 : Disconnect
X : Either 0 or 1

Pin Assignment

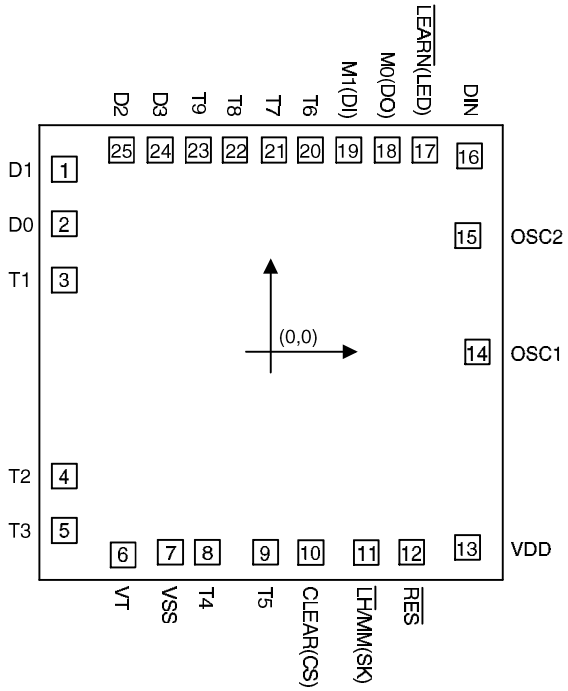


HT6P11
– 16 DIP/SOP

Block Diagram



Pad Coordinates



Chip size: 2400 × 2500 (μm)^2

* The IC substrate should be connected to VSS in the PCB layout artwork.
* The T5 pad must be bonded to VDD or VSS.
* The T1~T9 pads for IC test only.

Unit: μm

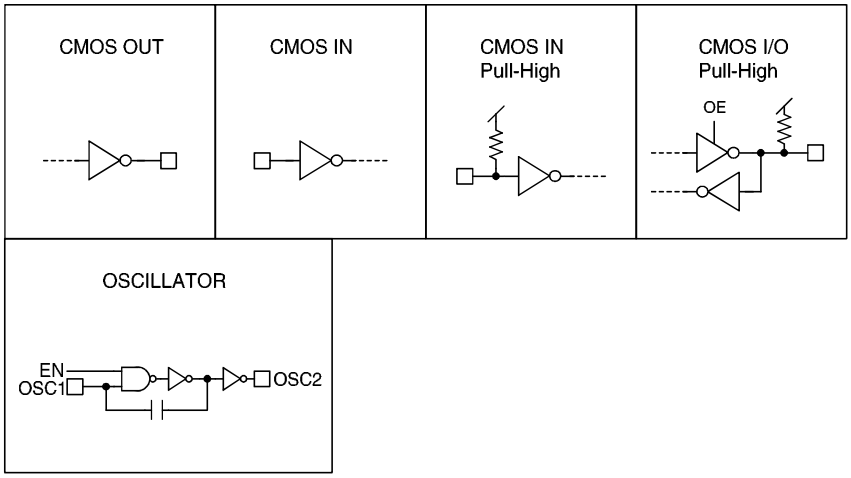
Pad No.	X	Y	Pad No.	X	Y
1	–1034.40	914.20	14	1034.40	1.20
2	–1034.40	641.00	15	985.00	583.30
3	–1034.40	360.20	16	993.20	980.40
4	–1034.40	–620.30	17	769.90	1010.4
5	–1034.40	–893.30	18	582.50	1010.4
6	–739.00	–1014.40	19	390.60	1010.4
7	–503.40	–1001.30	20	198.50	1010.4
8	–318.40	–1001.60	21	16.00	1010.4
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

<table>
<tr><th>Pin Name</th><th>I/O</th><th>Internal Connection</th><th>Description</th></tr>
<tr><td>M1(DI)</td><td>I</td><td>CMOS IN
Pull-High</td><td>To decide the mode operation
(refer to the functional description)
This pin is also used to input data from the EEPROM (connected to EEPROM DO pin).</td></tr>
<tr><td>M0(DO)</td><td>I/O</td><td>CMOS I/O
Pull-High</td><td>Input: To decide the mode operation (refer to the functional description)
Output: To activate the LED for indicating the function state (refer to the functional description)
This pin is also used to output the received data to the EEPROM (connected to EEPROM DI pin)</td></tr>
<tr><td>D0~D3</td><td>O</td><td>CMOS OUT</td><td>Output data pins, active high</td></tr>
<tr><td>VT</td><td>O</td><td>CMOS OUT</td><td>Valid transmission indication, active high</td></tr>
<tr><td>VSS</td><td>I</td><td>—</td><td>Negative power supply (GND)</td></tr>
<tr><td>CLEAR(CS)</td><td>I/O</td><td>CMOS I/O</td><td>Input: All data in the EEPROM are erased if the $\overline{\text{LEARN}}$(LED) pin is turned low and the CLEAR(CS) pin is turned high over 1 second, or if the CLEAR(CS) pin is turned high for more than 1 second under the learning state.
Output: EEPROM chip selection signal output (connected to EEPROM CS pin)</td></tr>
<tr><td>$\overline{\text{LH}}$/MM(SK)</td><td>I/O</td><td>CMOS I/O
Pull-High</td><td>Input: Data output type selection
The type should be set before power is turned on or the system is reset. When the $\overline{\text{LH}}$/MM(SK) pin is pulled-low externally, the data output is of the latch type. Otherwise it is of the latch type.
Output: Serial clock output to the EEPROM (connected to EEPROM SK pin)</td></tr>
<tr><td>$\overline{\text{RES}}$</td><td>I</td><td>CMOS IN</td><td>Input for resetting the chip inside, active low</td></tr>
<tr><td>VDD</td><td>I</td><td>—</td><td>Positive power supply</td></tr>
<tr><td>OSC1</td><td>I</td><td>OSCILLATOR</td><td>Oscillator input pin</td></tr>
<tr><td>OSC2</td><td>O</td><td>OSCILLATOR</td><td>Oscillator output pin, $F_{OSC}/4$ frequency output</td></tr>
<tr><td>DIN</td><td>I</td><td>CMOS IN</td><td>Serial information input pin from a receiver</td></tr>
<tr><td>$\overline{\text{LEARN}}$(LED)</td><td>I/O</td><td>CMOS I/O
Pull-High</td><td>Input: To set the chip into the learning state, or to erase all the EEPROM data when used with the CLEAR key, active low
Output: To sink the LED current for status indication</td></tr>
</table>

M0	M1	Mode
0	0	Mode 0
1	0	Mode 1
X	1	Mode 2

Approximate internal connection circuits



Absolute Maximum Ratings*

Supply Voltage ..... –0.3V to 5.2V
Storage Temperature..... –50°C to 125°C
Input Voltage..... V_{SS}–0.3V to V_{DD}+0.3V
Operating Temperature..... –20°C to 75°C

*Note: Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only. Functional operation of this device at these or any other conditions above those indicated in the operational sections of this specification is not implied and exposure to absolute maximum rating conditions for extened periods may affect device reliability.

Electrical Characteristics

(Ta=25°C)

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V_{DD}	Conditions				
V_{DD}	Operating Voltage	—	—	2.4	5	5.2	V
I_{DD}	Operating Current	5V	No load F_{OSC}=2MHz	—	1	2	mA
I_{OH1}	Data Output Source Current (D0~D3)	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}	M0(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~D3)	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

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V_{DD}	Conditions				
I_{OL3}	M0 (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	V
R_{PH}	$\overline{LH}$/MM(SK), $\overline{LEARN}$(LED), M0(DO), M1(DI) 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

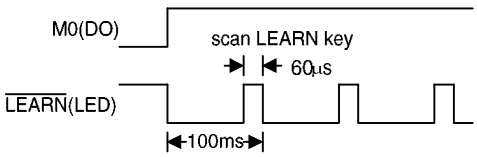
The HT6P11 is a 2^{24} decoder for remote control system applications. It can interface with HOLTEK's EEPROM (HT93LC46) and store 8 sets of encoder information at maximum. The decoder provides 0/2/4 data outputs for various applications.

Operation

- Waiting state operation

  The HT6P11 enters the waiting state if none of the customer codes exist in the EEPROM after turning on the power.

  In the waiting state, the M0(DO) pin is high and the $\overline{LEARN}$(LED) pin outputs a scanning signal indicating the empty of EEPROM and performing the LEARN key scaning. The waveform in shown in the following diagram where 10ms positive pulses are used to scan-input the status of the $\overline{LEARN}$(LED) pin. Once a valid trigger signal is received, it goes to the learning state.

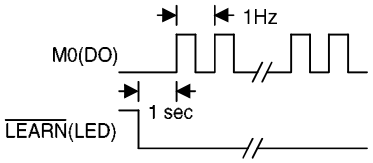


Waiting state LED timing

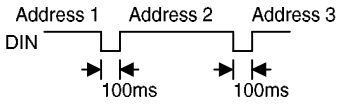
- Learning state operation

  The HT6P11 goes into the learning state after pressing the LEARN key active low over 1 second if the EEPROM is not full. In the learning state, the $\overline{LEARN}$(LED) pin is set to low and the M0(DO) pin output a flash signal at a 1Hz rate. If the DIN pin receives proper formatted address information and no mistakes are made after 5 times of check, the received addresses will be stored into the EEPROM, additionally the M0(DO) pin stops flashing and the $\overline{LEARN}$(LED) pin turns high. When the learning is completed, the system then returns to the standby state. On the other hand, if the DIN pin has no proper formatted information input to it, the M0(DO) pin will stop flashing and the $\overline{LEARN}$(LED) pin turns high after 10 seconds and the learning process is invalid.

  The HT6P11 can save a maximum of 8 sets of addresses in the EEPROM. Once the EEPROM has stored 8 sets of addresses in it, the HT6P11 cannot enter the learning state any more. The D0~D3 and VT pins are all held low during in the learning state.



Learning state LED timing



Successive learning timing

- EEPROM erase function

  All data in the EEPROM are erased if the LEARN(LED) pin is turned low and the CLEAR(CS) pin is turned high for more than 1 second, or if the CLEAR(CS) pin is turned high for more than 1 second in the learning state. Once the EEPROM is erased, the M0(DO) pin output a high level signal and the LEARN(LED) pin is active low.

- Remote control state

  The HT6P11, paired with the 2^{24} series of encoders, provides three kinds of combinations of address and data that are decided by the M0 and M1 pins. The decoder receives data transmitted by an encoder and interprets the first N bits as address and the last (24-N) bits as data (the number of N is decided by M0, M1 pins). The HT6P11 will check the received addresses three times continuously. If the received address codes match one of the contents of the EEPROM's local addresses, the (24-N) bits of data are decoded to activate the output pins (D0~D3). At this time, the VT pin is set high and the M0(DO) pin is turned high and the LEARN(LED) pin outputs a low_level signal to indicate a valid transmission.

Output type

- Data pin output type

  The initial data pins (D0~D3) are all at low_level after power is turned on. After the D0~D3 data pins are activated by a valid transmission in the remote control state, two types of outputs, namely momentary type and latch type, can be selected and decided by the LH/MM (SK) pin.

  - Momentary type

    No external pull-low on the LH/MM(SK) pin

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

  - Latch type

    Externally pulled-low on the LH/MM(SK) pin

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

    If the status of the LH/MM(SK) or M0 and M1 pins are changed, the RESET key has to be pressed or power has to be switched off and on again or the EEPROM has to be erased. Otherwise, the change is ineffective.

- VT pin output type

  The VT pin outputs a high_level signal to indicate a valid transmission in the remote control state. Otherwise, it is always low.

- M0(DO) and LEARN(LED)

  The following three states are indicated by the M0(DO) and LEARN(LED) pins:

  - System in the waiting state

    In the waiting state, the M0(DO) pin outputs high_level and the LEARN(LED) pin outputs low_level if no data exist in the EEPROM.

    But if there are data in the EEPROM the M0(DO) outputs low_level, and the LEARN(LED) pin outputs high_level.

  - System in the remote control state

    The M0(DO) pin outputs a high_level signal and the LEARN(LED) pin outputs a low_level signal to indicate a valid transmission.

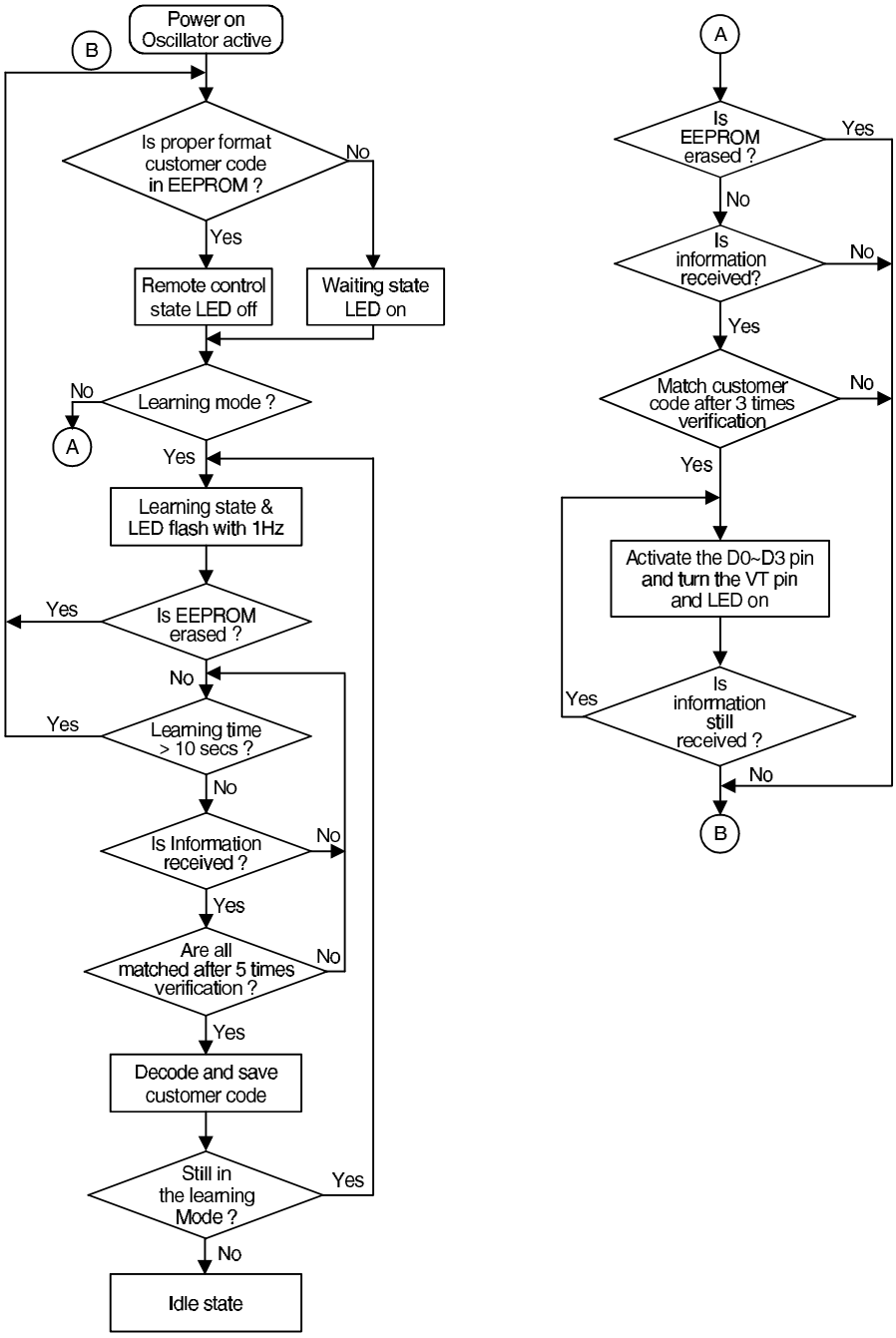
  - System in the learning state

    In the learning state, the M0(DO) pin flashes at a 1Hz rate and the LEARN(LED) pin turns low for 10 seconds at maximum (refer to the learning state operation).

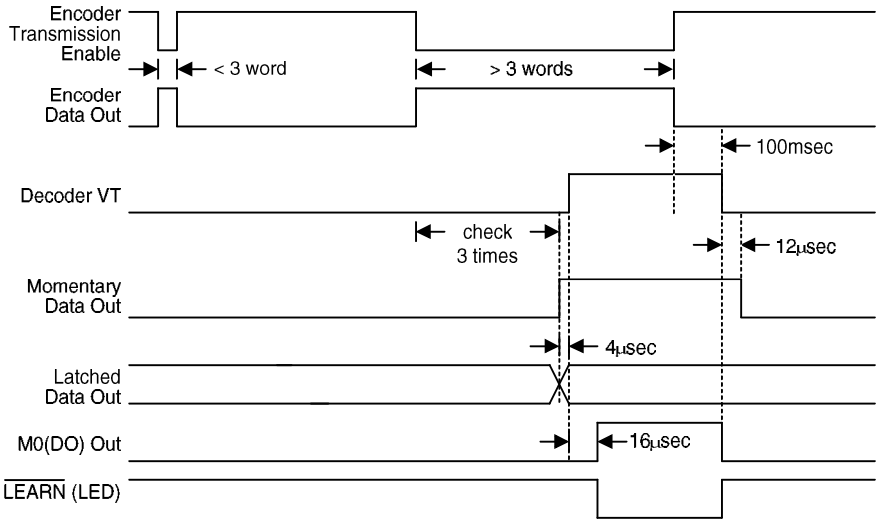
- Anti-scan

  The HT6P11 possesses an anti-scan function which pauses the decoder for an illegal data when an approximate format is detected.

Operation flowchart



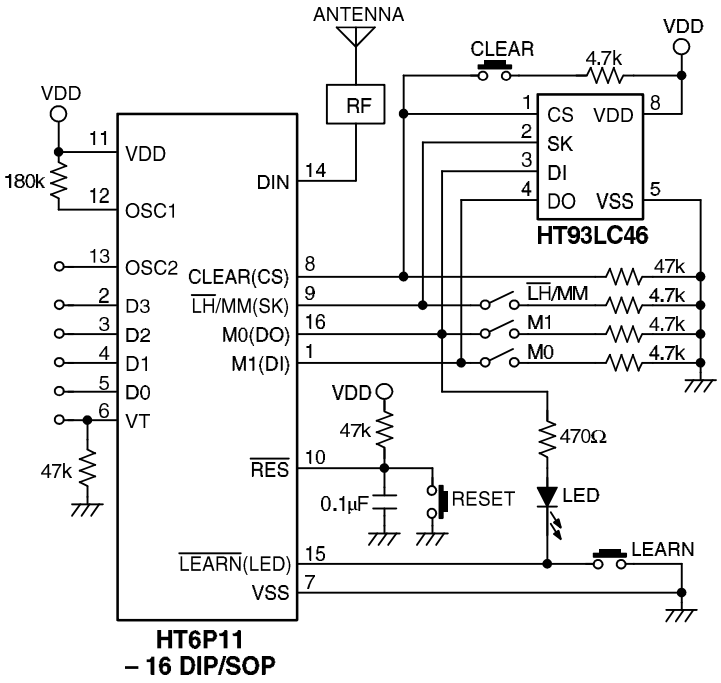
Decoder timing



Encoder/Decoder cross reference table

Part No.	Mode	Data	Address	VT	Pair Encoder	Package			
						Encoder		Decoder	
						DIP	SOP	DIP	SOP
HT6P11	Mode 0	0 bit	24 bits	√	HT6P20A	8	8	16	16
	Mode 1	2 bits	22 bits	√	HT6P20B	8	8		
					HT6P20C	16	16		
	Mode 2	4 bits	20 bits	√	HT6P20D	16	16		

Application Circuit



Note: Typical infrared receiver: PIC-12043T/PIC-12043S (KODESHI CORP.)
or LTM9052 (LITEON CORP.)

Typical RF receiver: JR-200 (JUWA CORP.)

The key resistance must be less than 200Ω when the LEARN key is pressed