HT6240-002
Infrared Remote Encoder

Features

- Operating voltage: 2.2V~3.6V
- Low power consumption
- Few external parts
- 20-pin DIP/SOP package
  24-pin SOP package

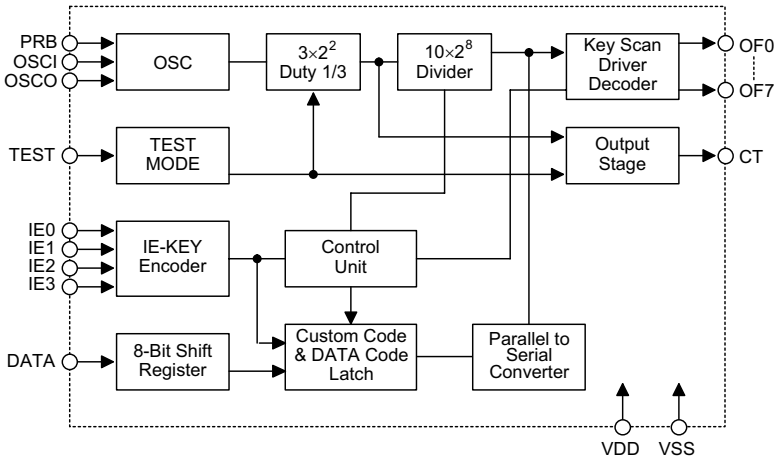
Applications

- Television and video cassette recorder controllers
- Garage door controllers
- Car door controllers
- Security systems
- Other remote control systems

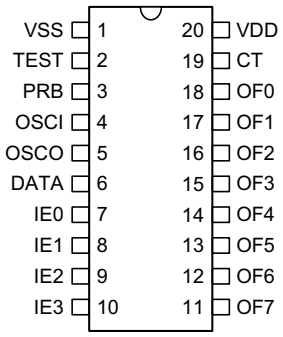
General Description

HT6240-002 is designed as infrared remote encoders, usually applied to TV systems. The 4×8 key matrix input and the extension bit input can transmit a max. of 256 instructions. HT6240-002 have three different packages: 20-pin DIP, 20-pin SOP and 24-pin SOP.

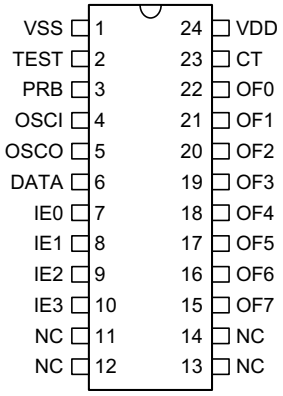
Block Diagram



Pin Assignment

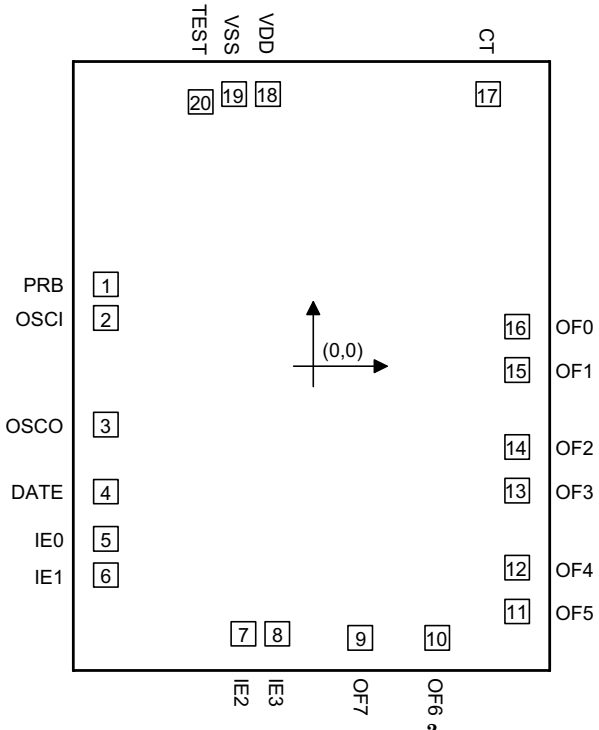


HT6240-002
– 20 DIP/SOP



HT6240-002
– 24 SOP

Pad Assignment



Chip size: 92 × 118 mil^2

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

Pad Coordinates

Unit: mil

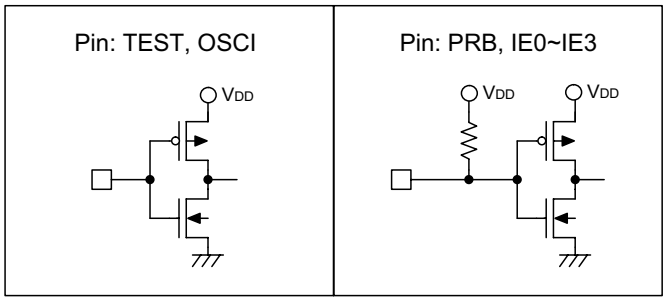
Pad No.	X	Y	Pad No.	X	Y
1	–40.88	16.11	11	40.12	–48.32
2	–40.88	9.48	12	40.12	–39.74
3	–40.88	–11.56	13	40.12	–24.57
4	–40.88	–24.78	14	40.12	–15.98
5	–40.88	–34.04	15	40.12	–0.81
6	–40.88	–41.18	16	40.12	7.78
7	–13.77	–52.78	17	34.47	53.59
8	–7.14	–52.78	18	–8.97	53.59
9	9.22	–53.55	19	–15.60	53.59
10	24.40	–53.55	20	–22.23	52.02

Pad Description

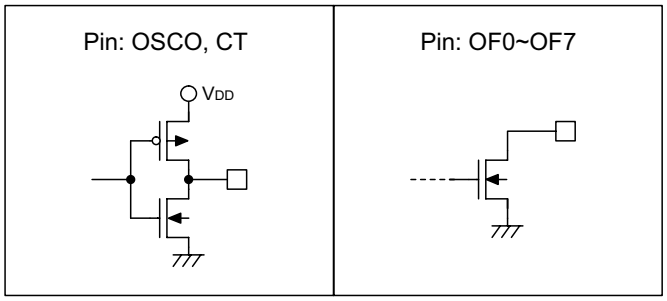
Pad No.	Pad Name	I/O	Internal Connection	Description
1	PRB	I	CMOS Pull-high	Power on reset
2	OSCI	I	CMOS	Oscillator input
3	OSCO	O	CMOS	Oscillator output
4	DATA	I/O	CMOS, NMOS Pull-high	Detect custom code and extended code
5~8	IE0~IE3	I	CMOS Pull-high	Detect input from key matrix
9~16	OF7~OF0	O	NMOS	Drive for key scan
17	CT	O	CMOS	Generates output transmission code
18	VDD	—	—	Positive power supply
19	VSS	—	—	Negative power supply
20	TEST	I	CMOS	TEST=Low normal mode TEST=High test mode

Approximate internal connection circuits

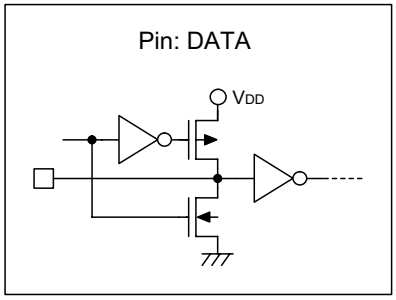
Input terminal



Output terminal



Bidirectional terminal



Absolute Maximum Ratings

Supply Voltage.....–0.3V to 5.2V
Output Voltage.....V_{SS} to V_{DD}
Operating Temperature.....–20°C to 70°C
Input Voltage.....V_{SS}–0.3 to V_{DD}+0.3
Storage Temperature.....–40°C to 125°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.

Recommended Operating Condition

Ta=–20°C~70°C, unless otherwise noted

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V_{DD}	Conditions				
V_{DD}	Supply Voltage	—	—	2.2	—	3.6	V
V_{IH}	High-level Input Voltage IE0~IE3, DATA	3V	—	2.4V	3V	3V	V
	High-level Voltage PRB	3V	—	2.1V	3V	3V	
V_{IL}	Low-level Input Voltage IE0~IE3, DATA	3V	—	0	0	1.2V	V
	Low-level Input Voltage PRB	3V	—	0	0	0.9V	
f_{OSC}	Clock Oscillating Frequency	3V	—	—	455	—	kHz

Electric Characteristics

Ta=25°C, V_{DD}=3V, V_{SS}=0V, unless otherwise noted

Symbol	Parameter	Test Conditions		Limits			Unit
		V_{DD}	Conditions	Min.	Typ.	Max.	
V_{DD}	Supply Voltage	—	f_{OSC}=455kHz, Ta=–20°C~70°C	2.2	—	3.6	V
I_{DD}	Supply Current (during operation)	3V	f_{OSC}=455kHz	—	0.1	0.3	mA
I_{DD}	Supply Current (while not in operation)	3V	—	—	—	1	μA
I_{OH}	High-level Output Current CT	3V	V_{OH}=2V	–5	–10	—	mA
I_{OL}	Low-level Output Current CT	3V	V_{OL}=0.9V	0.3	0.8	—	mA
	Low-level Output Current DATA	3V	V_{OL}=0.9V	1	4	—	
	Low-level Output Current OF0~OF7	3V	V_{OL}=0.9V	1	4	—	
R_I	Pull-up Resistance PRB	3V	—	—	80	—	kΩ
	Pull-up Resistance DATA	3V	—	—	70	—	
	Pull-up Resistance E0~E3	3V	—	—	70	—	

Functional Description

Key operation

The input pins (IE0~IE3) and the output pins (OF0~OF7) constitute a max. of 4×8 key matrix which is also called standard key. The extended key is formed by input pin DATA and the scan output (OF5~OF7). The 4×8 key matrix and the extended key can transmit a max. of 256 instruction.

CT maintains "L" and no transmission code is generated when two or more keys in standard key are pressed.

Table 1 shows the relationship between the key matrix and the transmission code.

Table 1

Transmission Code / Key Input	D1	D0
IE0	0	0
IE1	0	1
IE2	1	0
IE3	1	1

Transmission Code / Scan Output	D4	D3	D2
OF0	0	0	0
OF1	0	0	1
OF2	0	1	0
OF3	0	1	1
OF4	1	0	0
OF5	1	0	1
OF6	1	1	0
OF7	1	1	1

Transmission Code / DATA Input	D7	D6	D5
OF5	—	—	1
OF6	—	1	—
OF7	1	—	—

Custom code

The custom code is made up of input pin DATA and scan output OF0~OF4. It has 8 bits (C0~C7); the lower 3 bits of the custom code (C5, C6 and C7) are fixed as "0".

Fig. 1 shows an example of custom code selection.

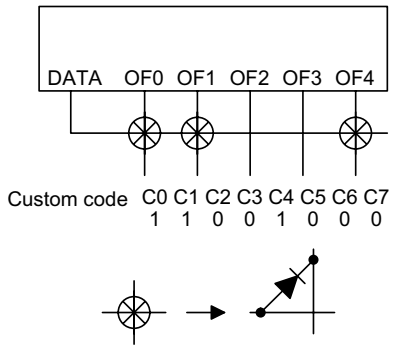


Fig. 1

Extended bit

The extended bit is formed by input pin DATA and the scan output (OF5~OF7). Fig. 2 shows an example of extended bit selection.

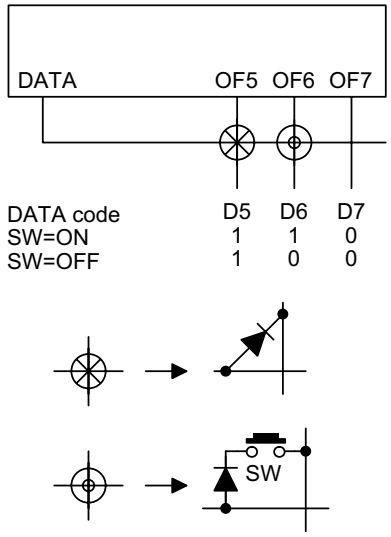


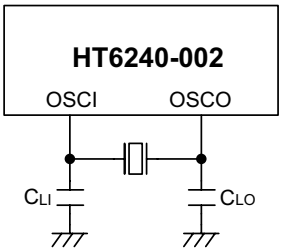
Fig. 2

Clock oscillating circuit

HT6240 has built-in feedback resistor and CMOS inverter, so a ceramic resonator can connect between the oscillator circuit input pin (OSCI) and the output pin (OSCO), (see Fig. 3).

When the ceramic resonator is set to 455kHz, the carrier can be set 38kHz.

The oscillating circuit will stop when there is no key pressed to save power dissipation.



Note: These capacitors depend on the resonators. Use the values recommended by the resonator manufacturer.

Fig. 3

Transmission code

When the resonator is 455kHz, the carrier of the transmission signal is 38kHz. One pulse width is 0.53ms. Therefore, twenty 38kHz clocks are included in the 0.53ms pulse width. (Fig.4 shows the carrier)

HT6240-002 has two different formats. When the custom code is equal to zero, CT will send the 1st format. Otherwise, it will send the 2nd format.

If the custom code (C0~C7) is "0000 0000" then Fig. 5 shows the formation of the transmission code. Fig. 6 shows the transmission code "0" and "1" and pulse width. Fig. 7 shows the formation of the 1-word transmission code. If a legal key is pressed, HT6240-002 will send at least five words (see Fig. 8).

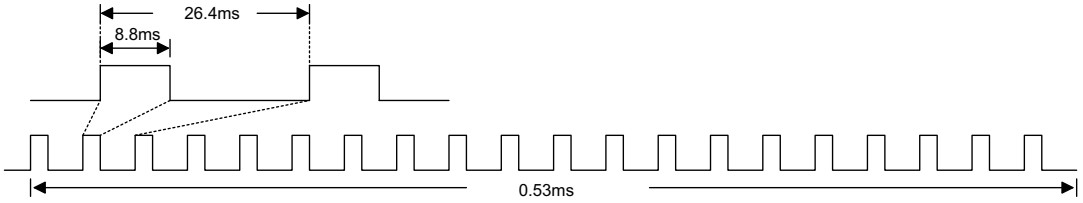


Fig. 4 Carrier

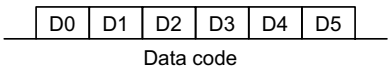


Fig. 5 Formation of the transmission code

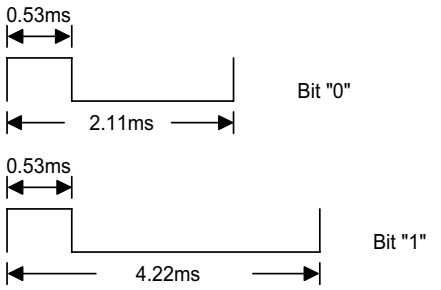


Fig. 6 Transmission code "0" and "1" and pulse width of HT6240-002

On table 2, the relationship between the key matrix and the transmission code is shown when custom code="0000 0000". The asterisks means that HT6240-002 can just send five words at a time even if a legal key is pressed for a long time. The others mean that HT6240-002 will send five or six words, even some more words if a legal key is still pressed.

Table 2

	OF0	OF1	OF2	OF3	OF4	OF5	OF6	OF7
IE0	00	04	08	0C	10*	14*	18*	1C*
IE1	01	05	09*	0D*	11*	15*	19*	1D*
IE2	02	06	0A*	0E*	12*	16*	1A*	1E*
IE3	03	07	0B*	0F*	13*	17*	1B*	1F*

There are 64 instructions when the custom code="0000 0000" in HT6240-002. The transmission output CT is still "L" and the transmission code will not be sent when two or more keys are pressed simultaneously.

If custom code ≠ "0000 0000" then Fig. 9 shows the formation of the transmission code. The transmission code consists of a head pulse, 8-bit custom code and 8-bit data code. Fig. 10 shows bit "0" and bit "1".

The formation of a 1-word transmission code without carrier is shown in detail in Fig.11. Output CT should combine with the carrier when CT is high.

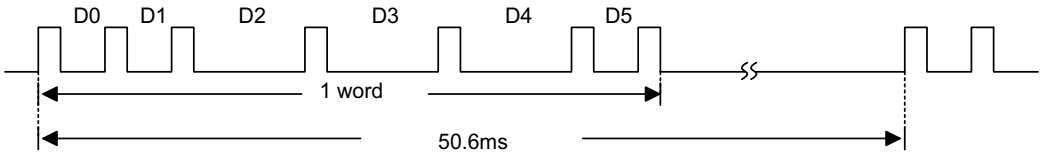


Fig. 7 The formation of the 1-word transmission code

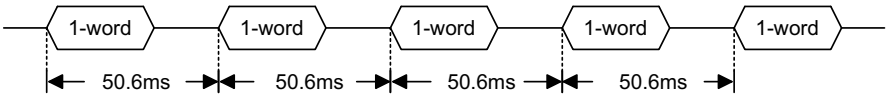


Fig. 8 A legal key will send at least five words

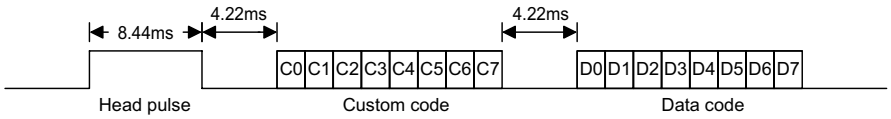


Fig. 9 The formation of the transmission code when custom code ≠ "0000 0000"

CT will send at least three words if we press a legal key. CT may send three or four words, or several words depending on the length of time the legal key is pressed. (see Fig. 12)

Power on reset function (PRB)

The power on reset function can be activated by connecting a capacitor to PRB pin while power is applied. The time (t_C) must be longer than 0.1ms when the voltage in PRB pin (V_C) becomes higher than $0.3V_{DD}$ after the voltage in V_{DD} pin exceeds 2.2V.

When the power on reset function is activated, the standby state continues until an "L" is input to IE0~IE3.

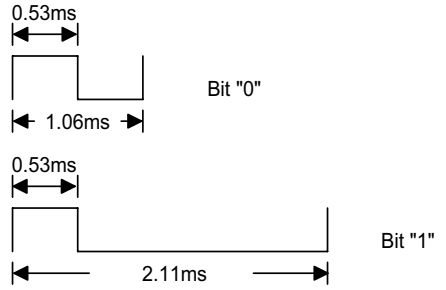


Fig. 10

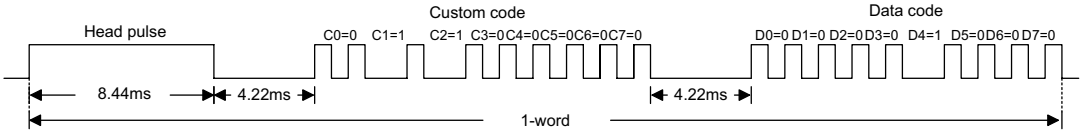


Fig. 11

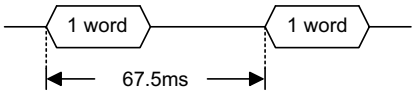


Fig. 12

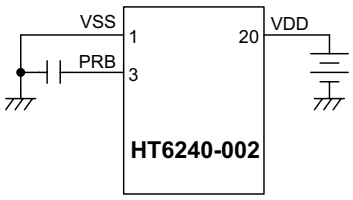


Fig. 13 Example of power-on reset function

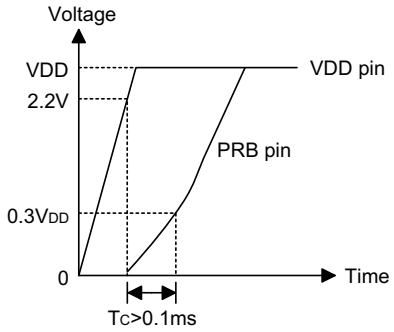
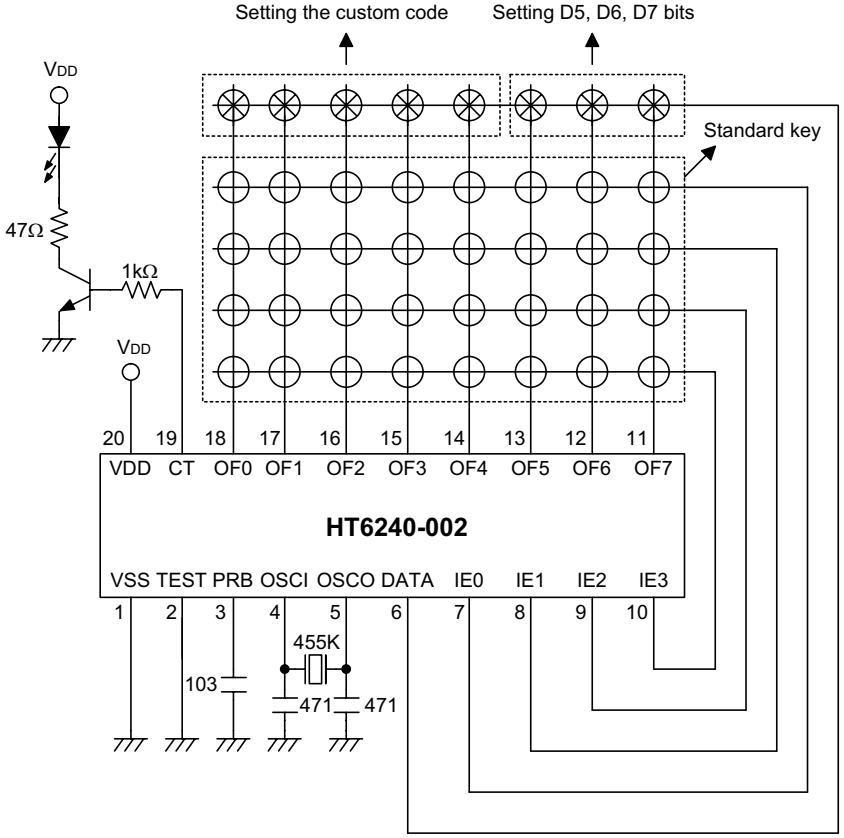
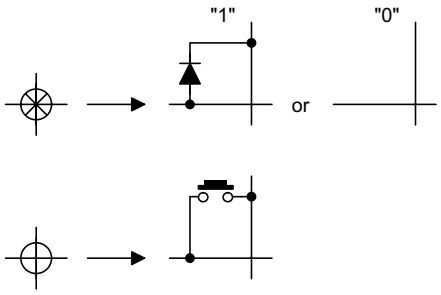


Fig. 14 Relationship between the PRB pin and the voltage

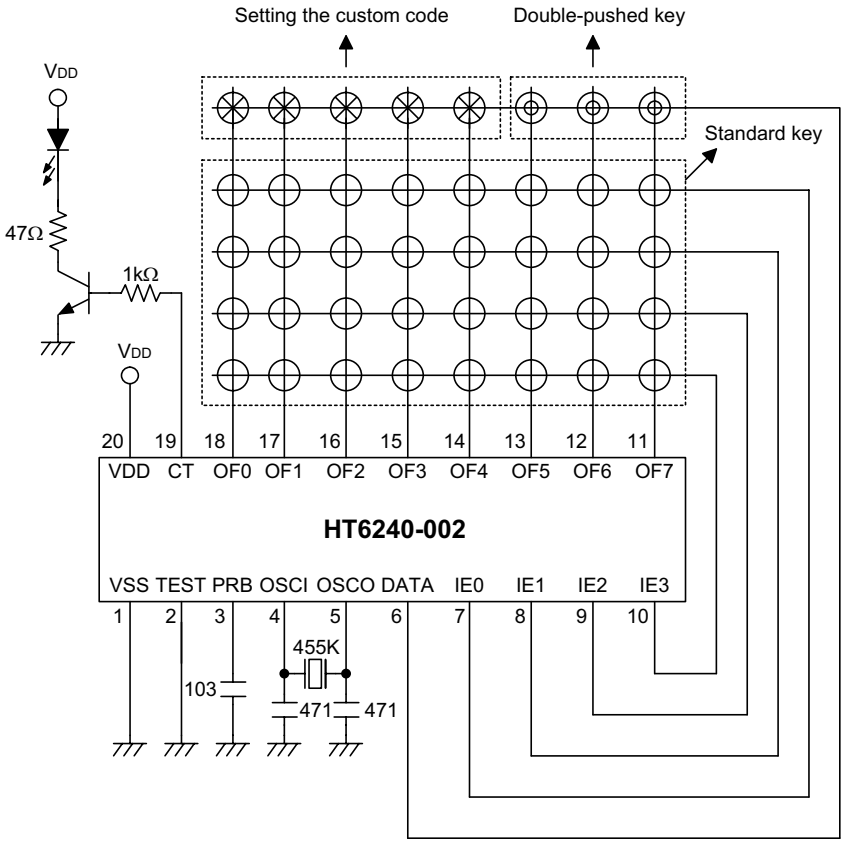
Application Circuits

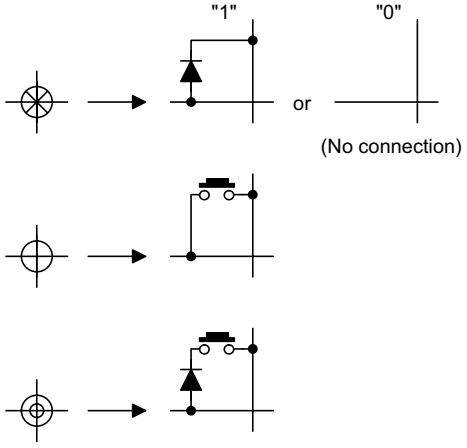
Example (1)



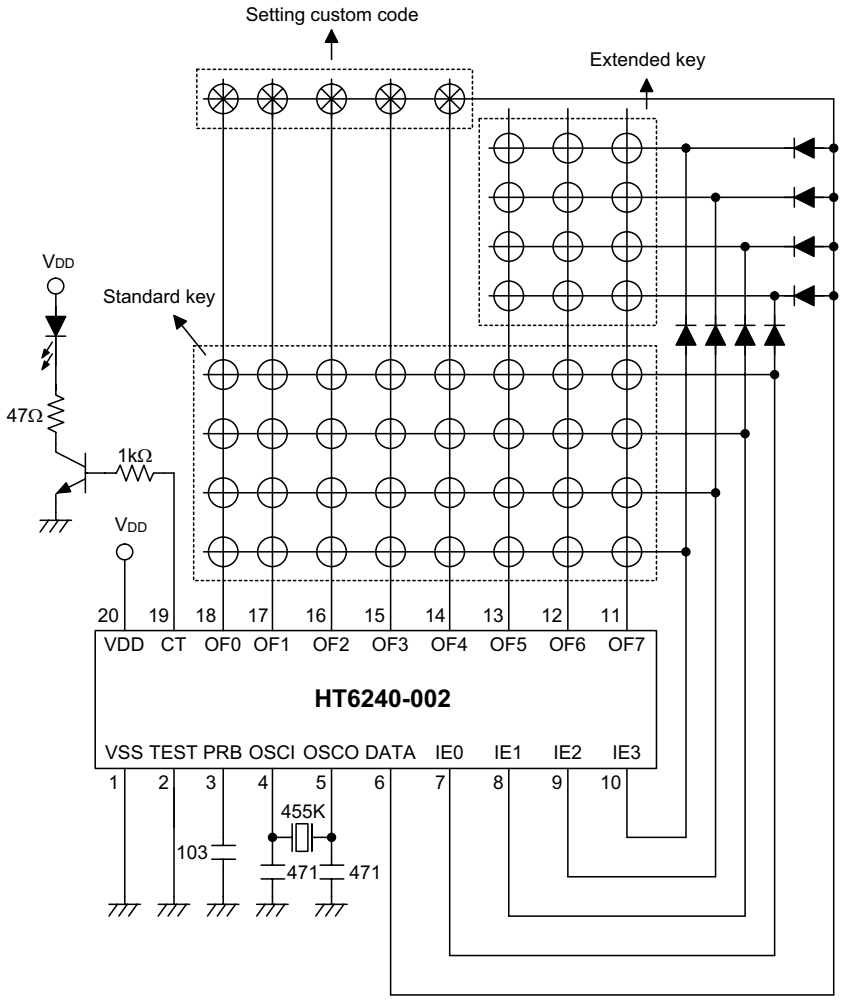


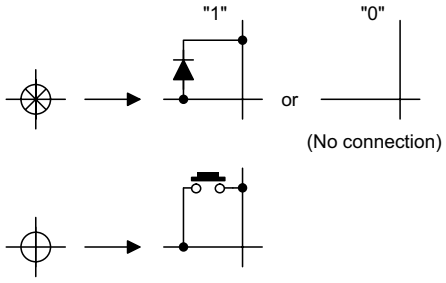
Example (2)


Setting the custom code
Double-pushed key
Standard key
VDD
47Ω
1kΩ
VDD
20 19 18 17 16 15 14 13 12 11
VDD CT OF0 OF1 OF2 OF3 OF4 OF5 OF6 OF7
HT6240-002
VSS TEST PRB OSCI OSCO DATA IE0 IE1 IE2 IE3
1 2 3 4 5 6 7 8 9 10
455K
103
471
471

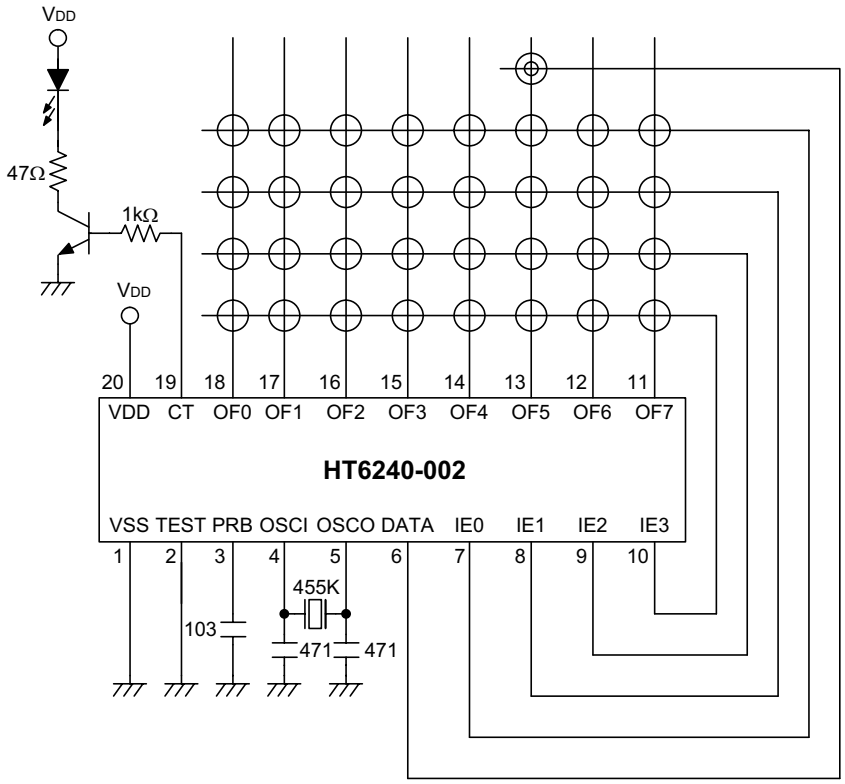

"1"
"0"
or
(No connection)

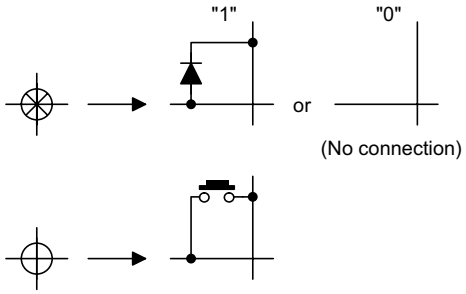
Example (3)


Setting custom code
Extended key
Standard key
VDD
47Ω
1kΩ
VDD
20 19 18 17 16 15 14 13 12 11
VDD CT OF0 OF1 OF2 OF3 OF4 OF5 OF6 OF7
HT6240-002
VSS TEST PRB OSCI OSCO DATA IE0 IE1 IE2 IE3
1 2 3 4 5 6 7 8 9 10
455K
103
471
471


"1"
"0"
or
(No connection)

Example (4)


VDD
47Ω
1kΩ
VDD
20 19 18 17 16 15 14 13 12 11
VDD CT OF0 OF1 OF2 OF3 OF4 OF5 OF6 OF7
HT6240-002
VSS TEST PRB OSCI OSCO DATA IE0 IE1 IE2 IE3
1 2 3 4 5 6 7 8 9 10
455K
103
471
471


"1"
"0"
or
(No connection)

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