HOLTEK

HT6240-001/HT6240-002
Infrared Remote Encoder

Features

- Operating voltage: 2.2V~3.6V
- Low power consumption
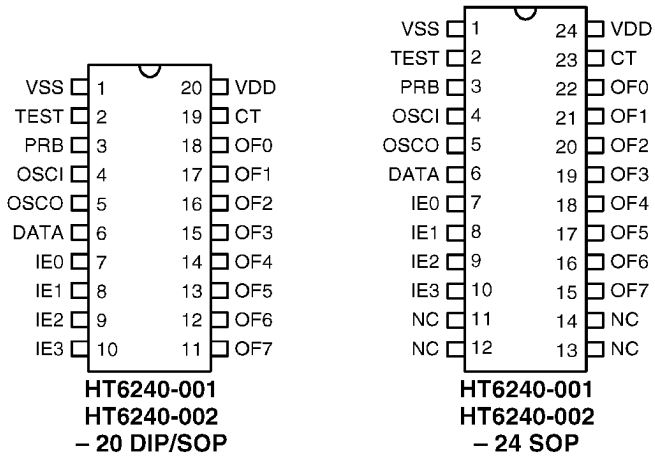- Few external parts

Applications

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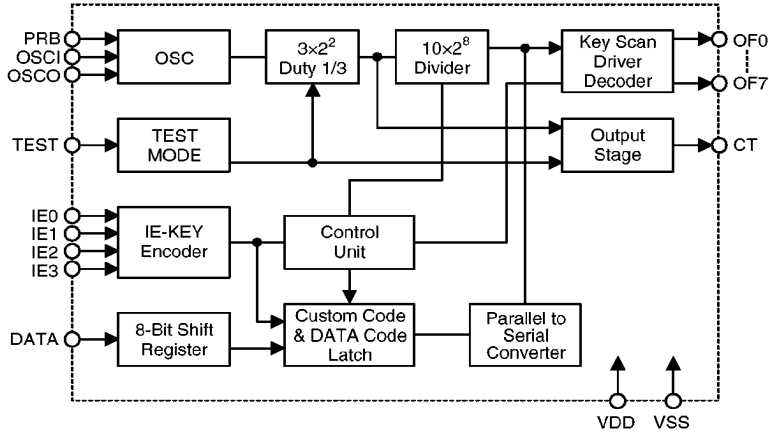- Other remote control systems

General Description

HT6240-001 and HT6240-002 are 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. HT6240-001 and HT6240-002 have three different packages: 20-pin DIP, 20-pin SOP and 24-pin SOP.
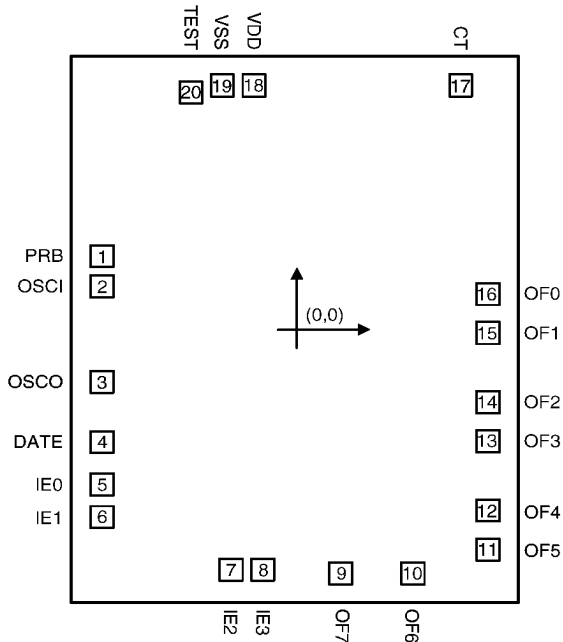
Pin Assignment

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

HT6240-001
HT6240-002
– 20 DIP/SOP

VSS	1	24	VDD
TEST	2	23	CT
PRB	3	22	OF0
OSCI	4	21	OF1
OSCO	5	20	OF2
DATA	6	19	OF3
IE0	7	18	OF4
IE1	8	17	OF5
IE2	9	16	OF6
IE3	10	15	OF7
NC	11	14	NC
NC	12	13	NC

HT6240-001
HT6240-002
– 24 SOP

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Block Diagram

Pad Assignment

Chip size: 92×118 mil^2

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

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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

HT6240-001 and HT6240-002 (20-pin DIP/SOP)

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	I	—	Positive power supply
19	VSS	I	—	Negative power supply
20	TEST	I	CMOS	TEST=Low normal mode TEST=High test mode

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Approximate internal connection circuits

Input terminal

Pin: TEST, OSCI	Pin: PRB, IE0~IE3

Output terminal

Pin: OSCO, CT	Pin: OF0~OF7
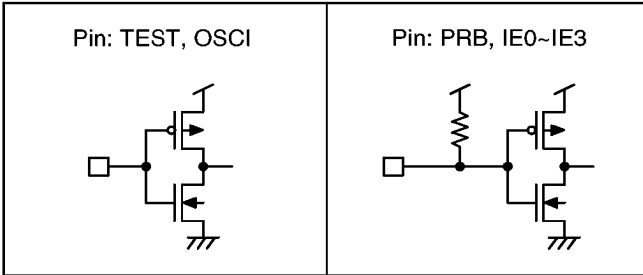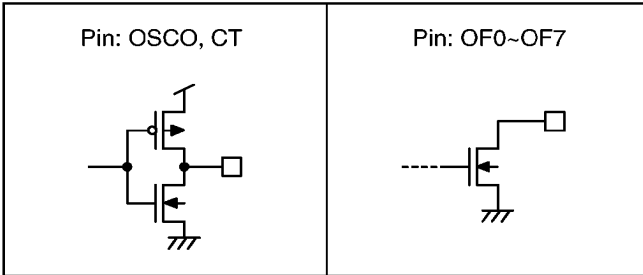
Bidirectional terminal

Pin: DATA
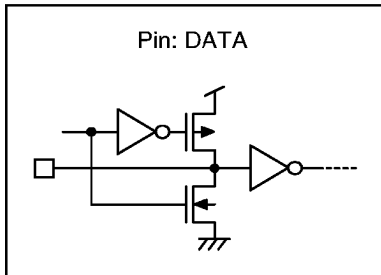
Absolute Maximum Ratings*

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.

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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.
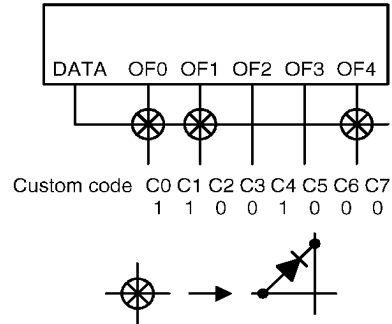
Fig. 1

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

6
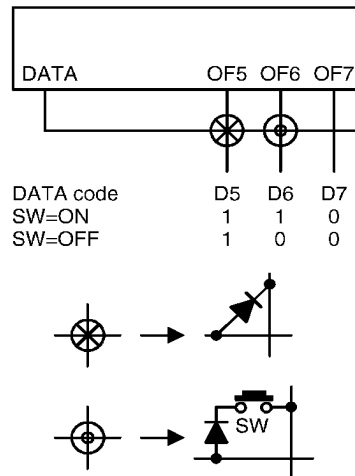
Clock oscillating circuit

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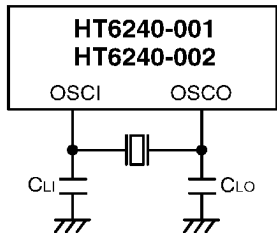
Note: These capacitors depend on the resonators. Use the values recommended by the resonator manufacturer.

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)

HT6240-001

HT6240-001 is similar to HT6240-002 except for the transmission code format. HT6240-001 has only one transmission code format (see Fig. 5) which shows the formation of the transmission code. The transmission code consists of the head pulse, 8-bit custom code and 8-bit data code. Fig. 6 shows bit "0" and bit "1" of HT6240-001. Fig. 7 shows the formation of the 1-word transmission code without carrier in detail (In fact, output CT should combine with the carrier when CT is high).

CT will send at least one word if a legal key is pressed. It may send one, two or several words depending on the length of time the legal key is pressed (see Fig. 8).

Fig. 6 Bit "0" and Bit "1" of HT6240-001

Fig. 4   Carrier

Fig. 5   The transmission code of HT6240-001

7
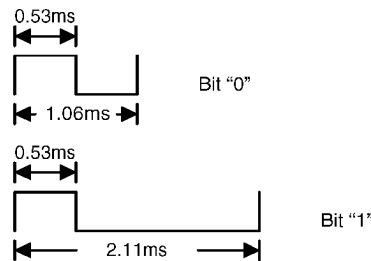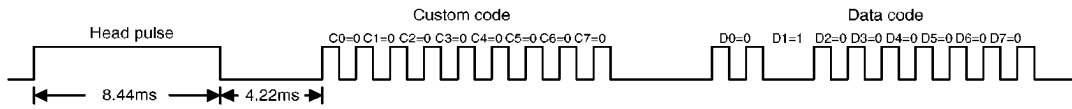
Fig. 7 The formation of the 1-word transmission code without carrier
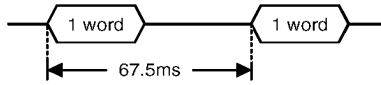

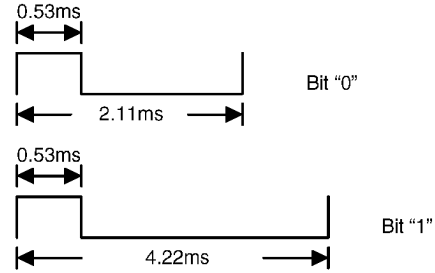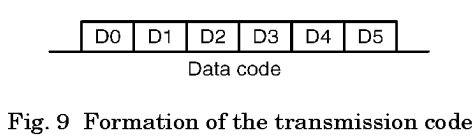Fig. 8

Fig. 9 Formation of the transmission code

Fig. 10 Transmission code "0" and "1" and pulse width of HT6240-002
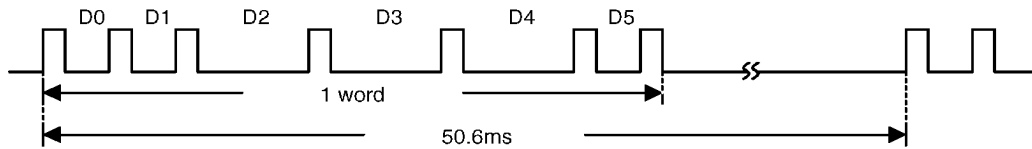

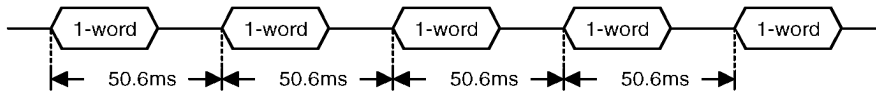Fig. 11 The formation of the 1-word transmission code

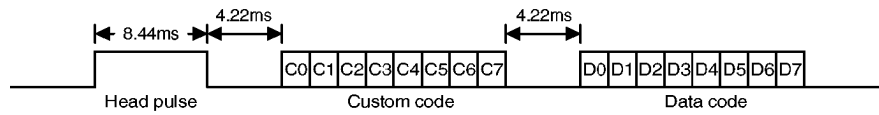
Fig. 12 A legal key will send at least five words

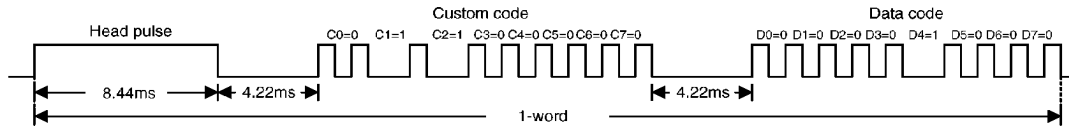Fig. 13 The formation of the transmission code when custom code ≠ "0000 0000"

Fig. 15

HT6240-002

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. 9 shows the formation of the transmission code. Fig. 10 shows the transmission code "0" and "1" and pulse width. Fig. 11 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. 12).

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. 13 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. 14 shows bit "0" and bit "1".
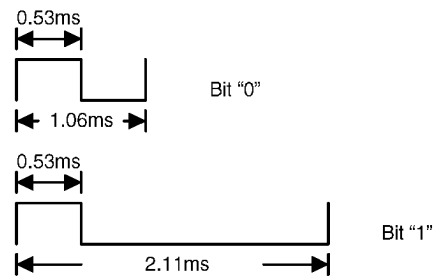

Fig. 14

The formation of a 1-word transmission code without carrier is shown in detail in Fig.15. Output CT should combine with the carrier when CT is high.

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. 16)
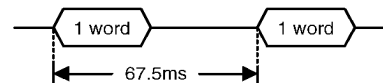

Fig. 16

9

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.

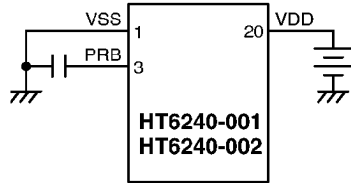When the power on reset function is activated, the standby state continues until an "L" is input to IE0~IE3.
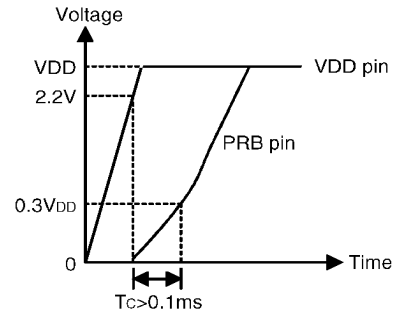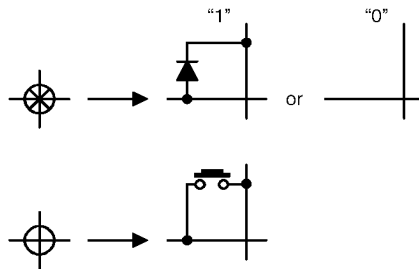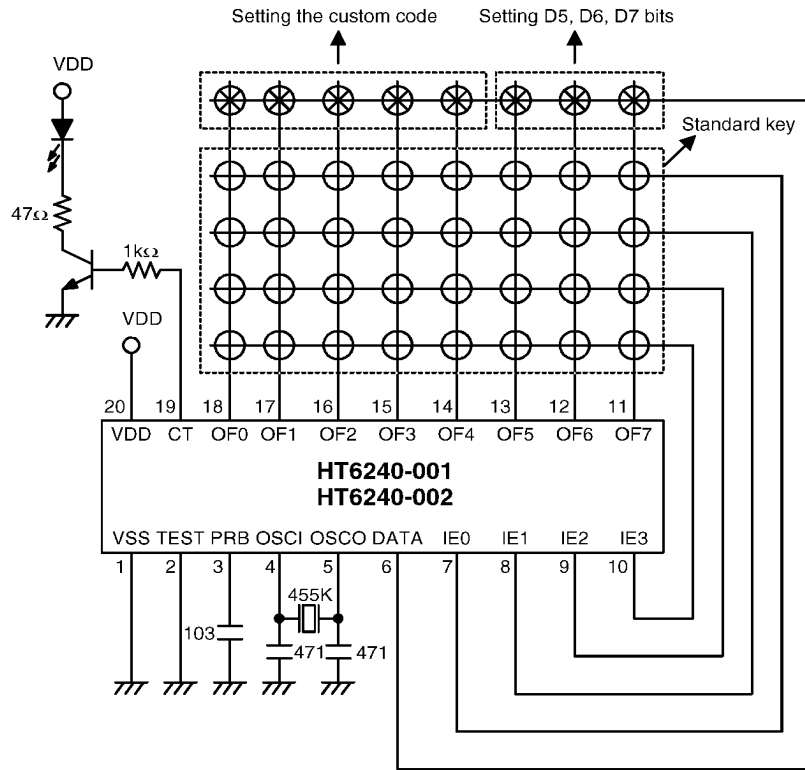
Fig. 17 Example of power-on reset function

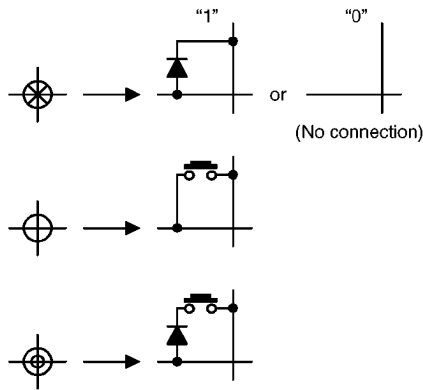Fig. 18 Relationship between the PRB pin and the voltage

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Application Circuits

Example (1)

Example (2)

Setting the custom code   Double-pushed key

Standard key

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Example (3)

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Example (4)

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