

**SANYO****LC7461M****Infrared Remote Control Transmitter IC****Functions**

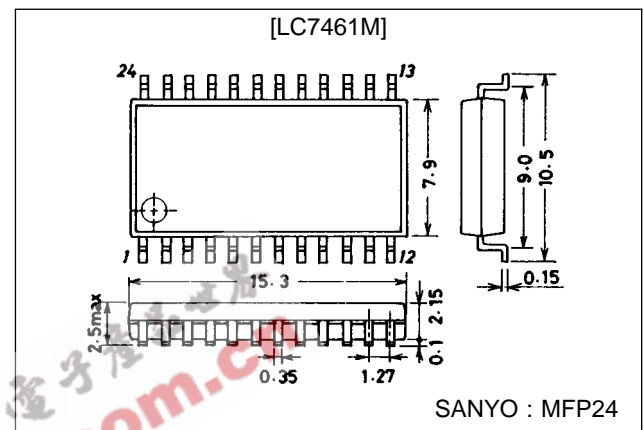
- 32⊕3 function keys
- 13-bit custom codes
- Operating supply voltage range  $V_{DD} = 1.8$  to  $3.6$  V
- Supply current at the standby mode  $I_{DD} = 1$   $\mu$ A or less
- Double-press operation keys (no priority given)
- On-chip oscillator (ceramic resonator : connected externally)

**Features**

- The custom code consists of 7 bits to be fixed by the on-chip ROM and 6 bits being pin-settable. Sixty-four custom codes may be selected externally (no diode required).
- Minimum number of external parts required

**Package Dimensions**

unit : mm

**3045B-MFP24****Specifications****Absolute Maximum Ratings at  $T_a = 25^\circ\text{C}$** 

| Parameter                   | Symbol        | Conditions                  | Ratings                      | Unit             |
|-----------------------------|---------------|-----------------------------|------------------------------|------------------|
| Maximum supply voltage      | $V_{DD\ max}$ | $V_{DD}$                    | $V_{SS}-0.3$ to $+5.5$       | V                |
| Input voltage               | $V_{IN}$      | Each input pin              | $V_{SS}-0.3$ to $V_{DD}+0.3$ | V                |
| Output voltage              | $V_{OUT}$     | Each output pin             | $V_{SS}-0.3$ to $V_{DD}+0.3$ | V                |
| Output current              | $I_{OUT}$     | OUT                         | -35                          | mA               |
| Allowable power dissipation | $P_{d\ max}$  | $T_a \leq 85^\circ\text{C}$ | 150                          | mW               |
| Operating temperature       | $T_{opr}$     |                             | -40 to +85                   | $^\circ\text{C}$ |
| Storage temperature         | $T_{stg}$     |                             | -50 to +125                  | $^\circ\text{C}$ |

**Allowable Operating Conditions at  $T_a = 25^\circ\text{C}$** 

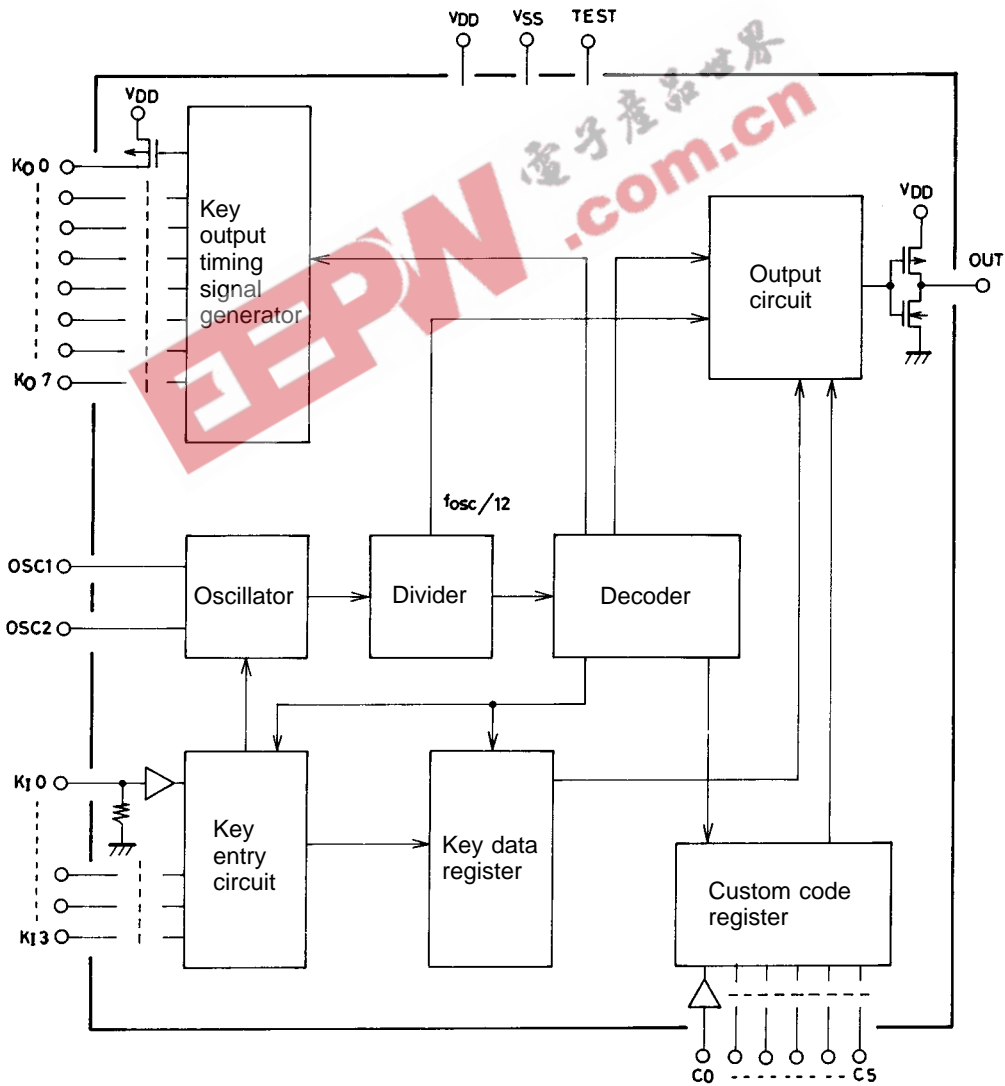
| Parameter                | Symbol    | Pin Name                             | Conditions          | min          | typ | max         | Unit |
|--------------------------|-----------|--------------------------------------|---------------------|--------------|-----|-------------|------|
|                          |           |                                      |                     |              |     |             |      |
| Supply voltage           | $V_{DD}$  | $V_{DD}$                             | $f_{OSC} = 455$ kHz | 1.8          | 3.0 | 3.6         | V    |
| Input high-level voltage | $V_{IH}$  | $K_10$ to $K_13$ ,<br>$C_0$ to $C_5$ |                     | $0.7 V_{DD}$ |     | $V_{DD}$    | V    |
| Input low-level voltage  | $V_{IL}$  | $K_10$ to $K_13$ ,<br>$C_0$ to $C_5$ |                     | $V_{SS}$     |     | $0.3V_{DD}$ | V    |
| Oscillation frequency    | $f_{OSC}$ |                                      |                     | 400          | 455 | 500         | kHz  |

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## Electrical Characteristics at $T_a = 25^\circ\text{C}$ , $V_{DD} = 3.0\text{ V}$

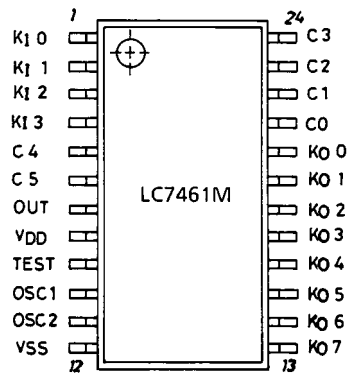
| Parameter                        | Symbol    | Pin Name       | Conditions  | min | typ | max          | Unit          |
|----------------------------------|-----------|----------------|---|-----|-----|--------------|---------------|
| Operating supply current         | $I_{DD}$  | $V_{DD}$       | Key ON, output: no load                           |     |     | 1            | mA            |
| Quiescent supply current         | $I_{DS}$  | $V_{DD}$       | All keys OFF, OSC stop                            |     |     | 1            | $\mu\text{A}$ |
| Output high-level current        | $I_{OH1}$ | OUT            | $V_{DD} = 1.8\text{ V}$ , $V_{OH} = 1.0\text{ V}$ |     | -8  |              | mA            |
|                                  | $I_{OH2}$ | OUT            | $V_{DD} = 3.0\text{ V}$ , $V_{OH} = 1.0\text{ V}$ |     | -25 |              | mA            |
| Output high-level voltage        | $V_{OH}$  | $K_0$ to $K_7$ | $I_{OH} = -0.1\text{ mA}$                         |     |     | 0.3          | V             |
| Output low-level voltage         | $V_{OL}$  | OUT            | $I_{OL} = 0.1\text{ mA}$                          |     |     | 0.3          | V             |
| Output OFF-state leakage current | $I_{OFF}$ | $K_0$ to $K_7$ |   |     |     | 1            | $\mu\text{A}$ |
| Input high-level current         | $I_{IH}$  | $C_0$ to $C_5$ | $V_{IN} = V_{DD}$                                 |     |     | 1            | $\mu\text{A}$ |
| Input low-level current          | $I_{IL}$  | $C_0$ to $C_5$ | $V_{IN} = V_{SS}$                                 | -1  |     |              | $\mu\text{A}$ |
| Input floating voltage           | $V_{IF}$  | $K_1$ to $K_3$ |   |     |     | $0.1 V_{DD}$ | V             |
| Input pull down resistance       | $R_{IN}$  | $K_1$ to $K_3$ |   | 75  | 100 | 125          | k $\Omega$    |

## Internal Block Diagram



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## Pin Assignment



Top view

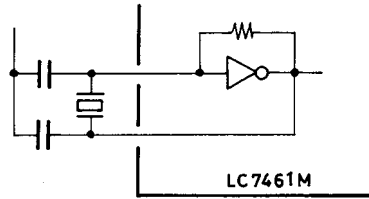
## Pin Description

| Pin Name                             | Pin No.           | Input/Output | Internal Equivalent Circuit | Pin Function  |
|--------------------------------------|-------------------|--------------|-----------------------------|---|
| V <sub>DD</sub> , V <sub>SS</sub>    | 8, 12             |              |                             | Power supply pins V <sub>SS</sub> = GND   |
| K <sub>O</sub> 0 to K <sub>O</sub> 7 | 13 to 20          | Output       |                             | Key scan timing signal output pins  |
| K <sub>I</sub> 0 to K <sub>I</sub> 3 | 1 to 4            | Input        |                             | Keys return signal entry pins   |
| OSC1<br>OSC2                         | 10<br>11          | Input/output |                             | Input/output pins for ceramic resonator-used oscillation<br><br>Oscillator configuration                                |
| C <sub>0</sub> to C <sub>5</sub>     | 21 to 24,<br>5, 6 | Input        |                             | Input pins for custom code setting<br>Capable of externally setting 6 bits of 13 bits in all that provide a custom code |
| OUT                                  | 7                 | Output       |                             | Output pin for transmit LED drive   |
| TEST                                 | 9                 | Input        |                             | LSI test pin<br>Normally set to high-level or brought to open state   |

**General Description of Function**

1. Oscillator

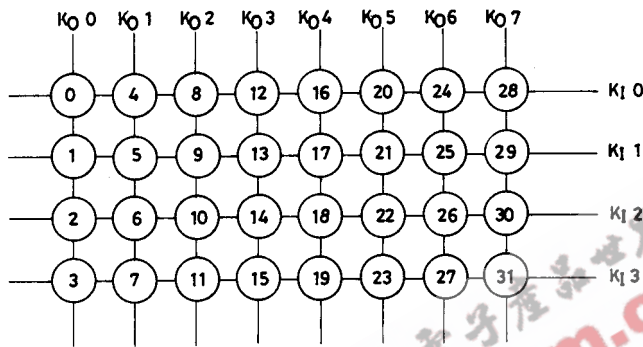
Since a self-bias type amplifier of CMOS inverter is contained, an oscillator can be formed by connecting a ceramic resonator.



To minimize power dissipation, the oscillator stops oscillating except when key operation is performed.

2. Key entry

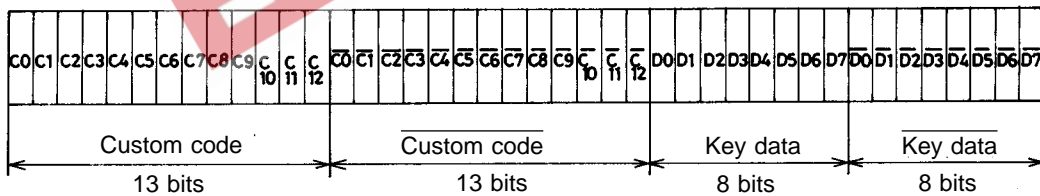
Key entry pins  $K_{I0}$  to  $K_{I3}$  and timing signal output pins  $K_{O0}$  to  $K_{O7}$  provide a key matrix of  $4 \times 8 = 32$ .



Multi-press of key No. 20 and one of key No. 21, 22, 23 may be done, with no priority given in key entry. When the two keys are kept pressed, a series of pulses will be output according to each key entry. If multi-press of keys which are not allowed multi-press is done, no output will be delivered.

3. Data organization

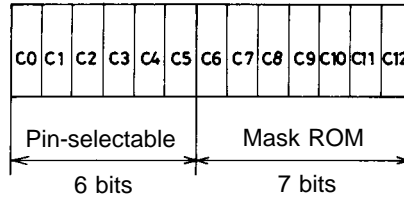
Data consists of 42 bits in all: 13 bits of custom code, 8 bits of key data, and their inverted codes.



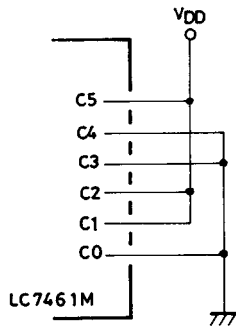
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## (a) Custom code

The custom code, which consists of 13 bits ( $C_0$  to  $C_{12}$ ) in all, is used to distinguish between receiving sets.



$C_6$  to  $C_{12}$  are fixed by the mask ROM and  $C_0$  to  $C_5$  are pin-settable.



In this example  $C_0$  to  $C_5$  are set as follows:

| $C_0$ | $C_1$ | $C_2$ | $C_3$ | $C_4$ | $C_5$ |
|-------|-------|-------|-------|-------|-------|
| 0     | 1     | 1     | 0     | 0     | 1     |

The custom codes are controlled by Sanyo to avoid duplication.

## (b) Key data

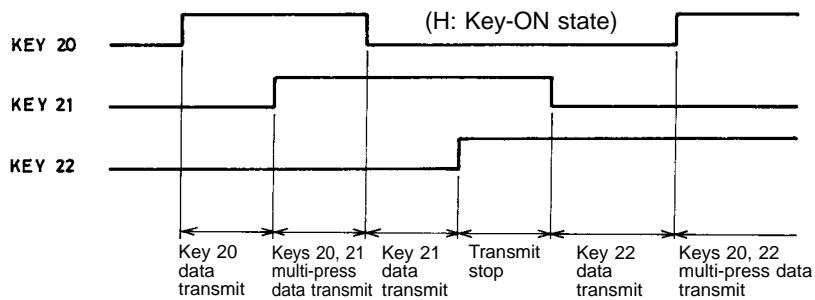
| KEY No. | D <sub>0</sub> | D <sub>1</sub> | D <sub>2</sub> | D <sub>3</sub> | D <sub>4</sub> | D <sub>5</sub> | D <sub>6</sub> | D <sub>7</sub> |
|---------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| 0       | 0              | 0              | 0              | 0              | 0              | 0              | 0              | 0              |
| 1       | 1              | 0              | 0              | 0              | 0              | 0              | 0              | 0              |
| 2       | 0              | 1              | 0              | 0              | 0              | 0              | 0              | 0              |
| 3       | 1              | 1              | 0              | 0              | 0              | 0              | 0              | 0              |
| 4       | 0              | 0              | 1              | 0              | 0              | 0              | 0              | 0              |
| 5       | 1              | 0              | 1              | 0              | 0              | 0              | 0              | 0              |
| ⋮       | ⋮              | ⋮              | ⋮              | ⋮              | ⋮              | ⋮              | ⋮              | ⋮              |
| 28      | 0              | 0              | 1              | 1              | 1              | 0              | 0              | 0              |
| 29      | 1              | 0              | 1              | 1              | 1              | 0              | 0              | 0              |
| 30      | 0              | 1              | 1              | 1              | 1              | 0              | 0              | 0              |
| 31      | 1              | 1              | 1              | 1              | 1              | 0              | 0              | 0              |

### Multi-press

| KEY No. | D <sub>0</sub> | D <sub>1</sub> | D <sub>2</sub> | D <sub>3</sub> | D <sub>4</sub> | D <sub>5</sub> | D <sub>6</sub> | D <sub>7</sub> |
|---------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| 20, 21  | 1              | 0              | 1              | 0              | 1              | 1              | 0              | 0              |
| 20, 22  | 0              | 1              | 1              | 0              | 1              | 1              | 0              | 0              |
| 20, 23  | 1              | 1              | 1              | 0              | 1              | 1              | 0              | 0              |

- $D_6, D_7$  may be preset to "0", "1" beforehand (mask option).

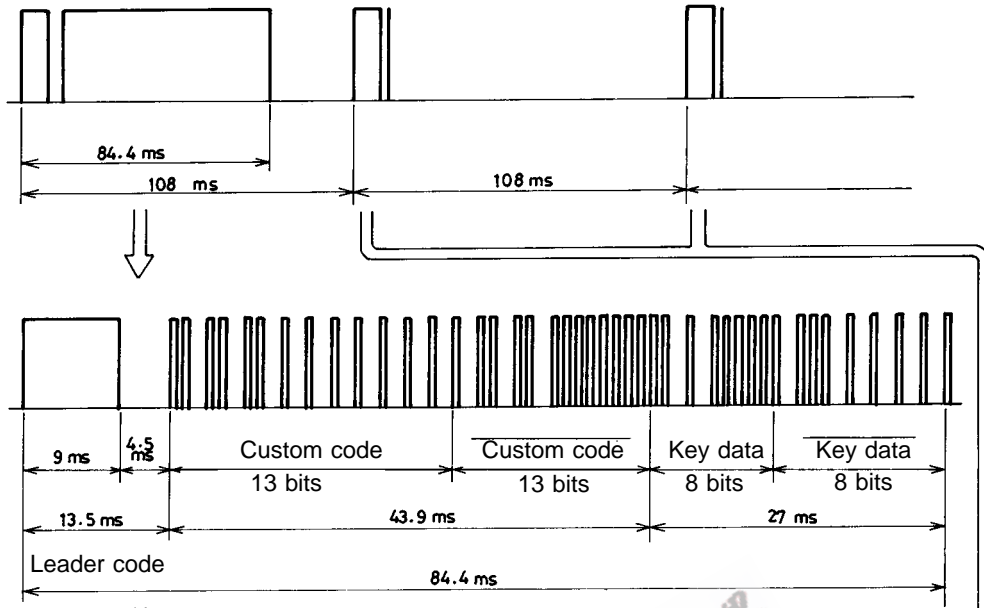
When multi-press of key No.20 and one of key No.21, 22, 23 is done, multi-bit  $D_5$  will be set to "1", with no priority given in key entry.



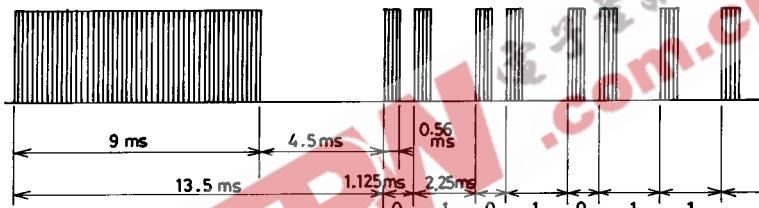
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## 4. Transmit waveforms

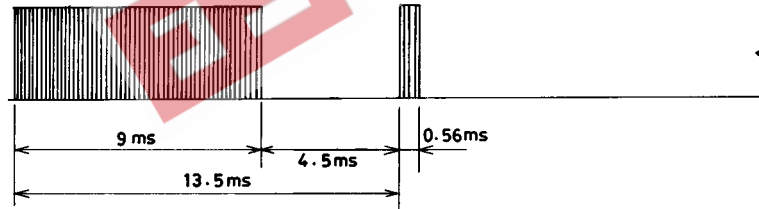
The period of time shown below is for  $f_{OSC} = 455 \text{ kHz}$ .



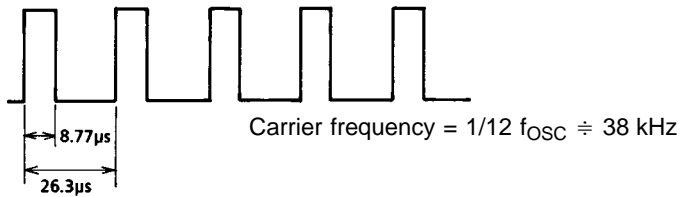
- First time



- Second time onward (Transmission is available only when key entry continues.)

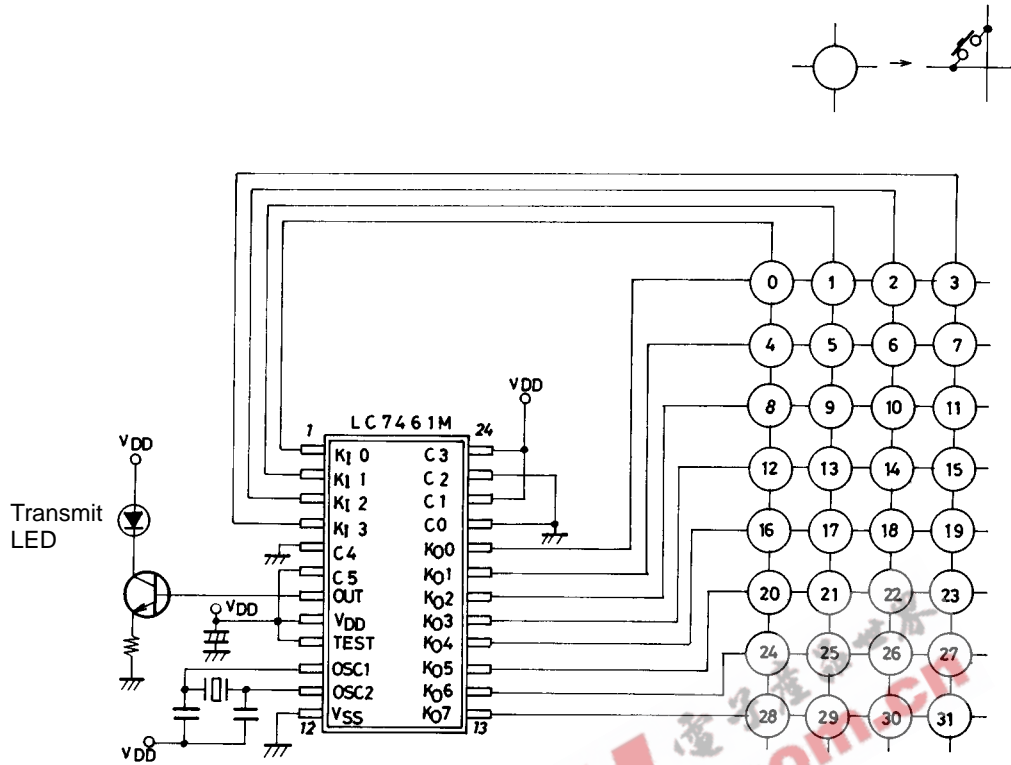


- Carrier waveform



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## Sample Application Circuit



In this example custom code  $C_0$  to  $C_5$  is  $C_0 \dots C_5$ .  
0 1 0 1 0 1

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