


**LC7461M**
**Infrared Remote Control Transmitter IC**

## Functions

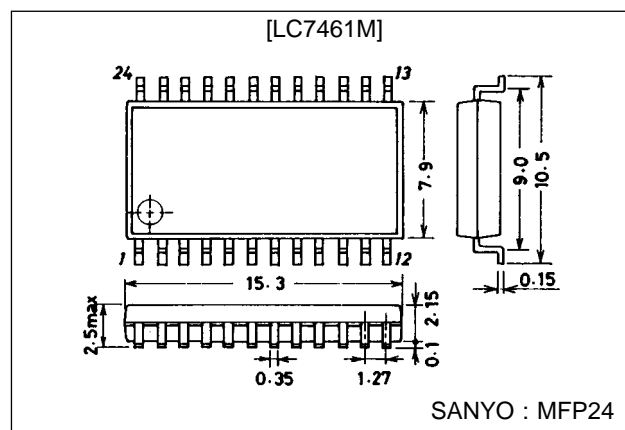
- 32⊕3 function keys
- 13-bit custom codes
- Operating supply voltage range  $V_{DD} = 1.8$  to  $3.6$  V
- Supply current at the standby mode  $I_{DD} = 1$   $\mu$ A or less
- Double-press operation keys (no priority given)
- On-chip oscillator (ceramic resonator : connected externally)

## 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 $T_a = 25^\circ\text{C}$

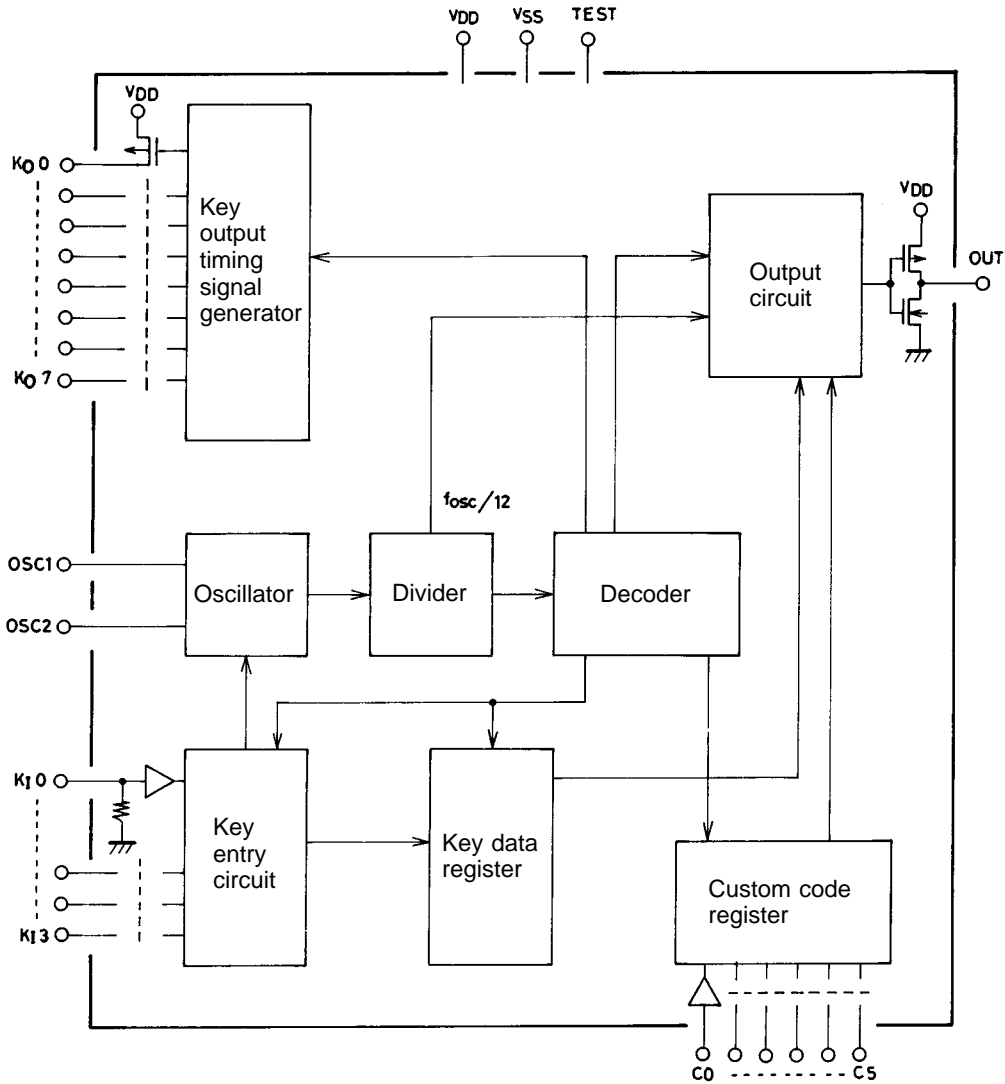
Parameter	Symbol	Pin Name	Conditions	min	typ	max	Unit
Supply voltage	$V_{DD}$	$V_{DD}$	$f_{OSC} = 455$ kHz	1.8	3.0	3.6	V
Input high-level voltage	$V_{IH}$	$K_10$ to $K_13$ , $C_0$ to $C_5$		$0.7 V_{DD}$		$V_{DD}$	V
Input low-level voltage	$V_{IL}$	$K_10$ to $K_13$ , $C_0$ to $C_5$		$V_{SS}$		$0.3V_{DD}$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

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

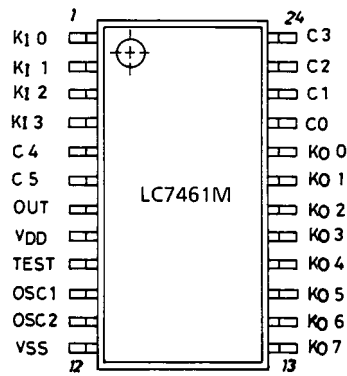
Parameter	Symbol	Pin Name	Conditions	min	typ	max	Unit
Operating supply current	$I_{DD}$	$V_{DD}$	Key ON, output: no load			1	mA
Quiescent supply current	$I_{DS}$	$V_{DD}$	All keys OFF, OSC stop			1	$\mu\text{A}$
Output high-level current	$I_{OH1}$	OUT	$V_{DD} = 1.8\text{ V}$ , $V_{OH} = 1.0\text{ V}$		-8		mA
	$I_{OH2}$	OUT	$V_{DD} = 3.0\text{ V}$ , $V_{OH} = 1.0\text{ V}$		-25		mA
Output high-level voltage	$V_{OH}$	$K_0$ 0 to $K_0$ 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	$I_{OFF}$	$K_0$ 0 to $K_0$ 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	$V_{IF}$	$K_1$ 0 to $K_1$ 3				$0.1 V_{DD}$	V
Input pull down resistance	$R_{IN}$	$K_1$ 0 to $K_1$ 3		75	100	125	k $\Omega$

## Internal Block Diagram



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## Pin Assignment



Top view

## Pin Description

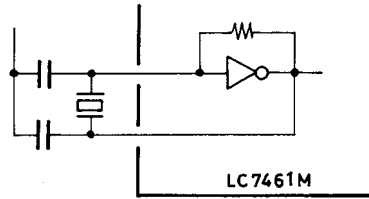
Pin Name	Pin No.	Input/Output	Internal Equivalent Circuit	Pin Function
V <sub>DD</sub> , V <sub>SS</sub>	8, 12			Power supply pins V <sub>SS</sub> = GND
K <sub>O</sub> 0 to K <sub>O</sub> 7	13 to 20	Output		Key scan timing signal output pins
K <sub>I</sub> 0 to K <sub>I</sub> 3	1 to 4	Input		Keys return signal entry pins
OSC1 OSC2	10 11	Input/output		Input/output pins for ceramic resonator-used oscillation  Oscillator configuration
C <sub>0</sub> to C <sub>5</sub>	21 to 24, 5, 6	Input		Input pins for custom code setting 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 Normally set to high-level or brought to open state

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## General Description of Function

### 1. Oscillator

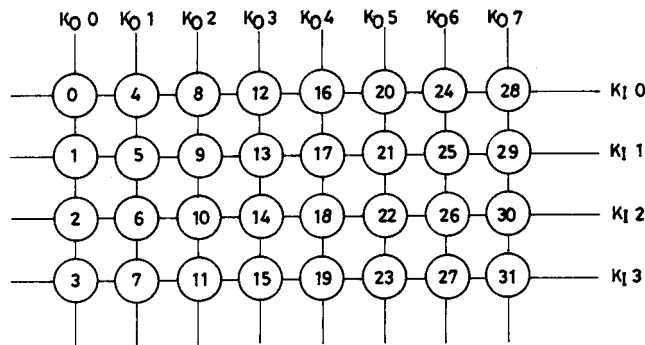
Since a self-bias type amplifier of CMOS inverter is contained, an oscillator can be formed by connecting a ceramic resonator.



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

### 2. Key entry

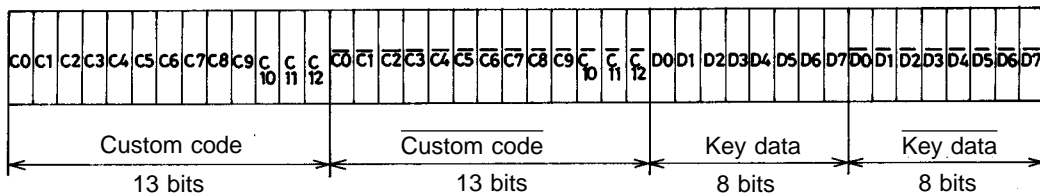
Key entry pins  $K_{I0}$  to  $K_{I3}$  and timing signal output pins  $K_{O0}$  to  $K_{O7}$  provide a key matrix of  $4 \times 8 = 32$ .



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

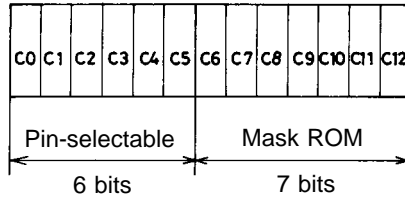
Data consists of 42 bits in all: 13 bits of custom code, 8 bits of key data, and their inverted codes.



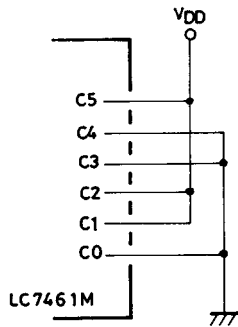
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(a) Custom code

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

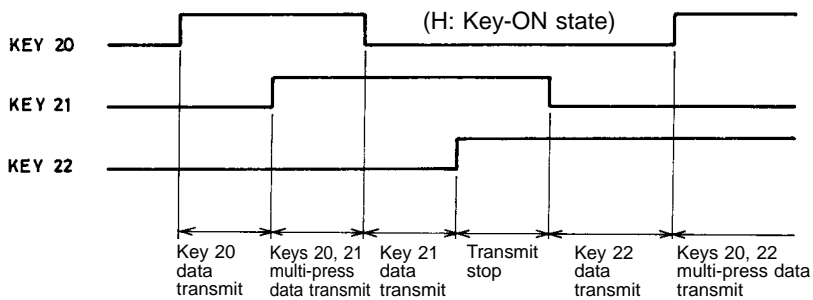
KEY No.	D <sub>0</sub>	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	D <sub>4</sub>	D <sub>5</sub>	D <sub>6</sub>	D <sub>7</sub>
0	0	0	0	0	0	0	0	0
1	1	0	0	0	0	0	0	0
2	0	1	0	0	0	0	0	0
3	1	1	0	0	0	0	0	0
4	0	0	1	0	0	0	0	0
5	1	0	1	0	0	0	0	0
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
28	0	0	1	1	1	0	0	0
29	1	0	1	1	1	0	0	0
30	0	1	1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

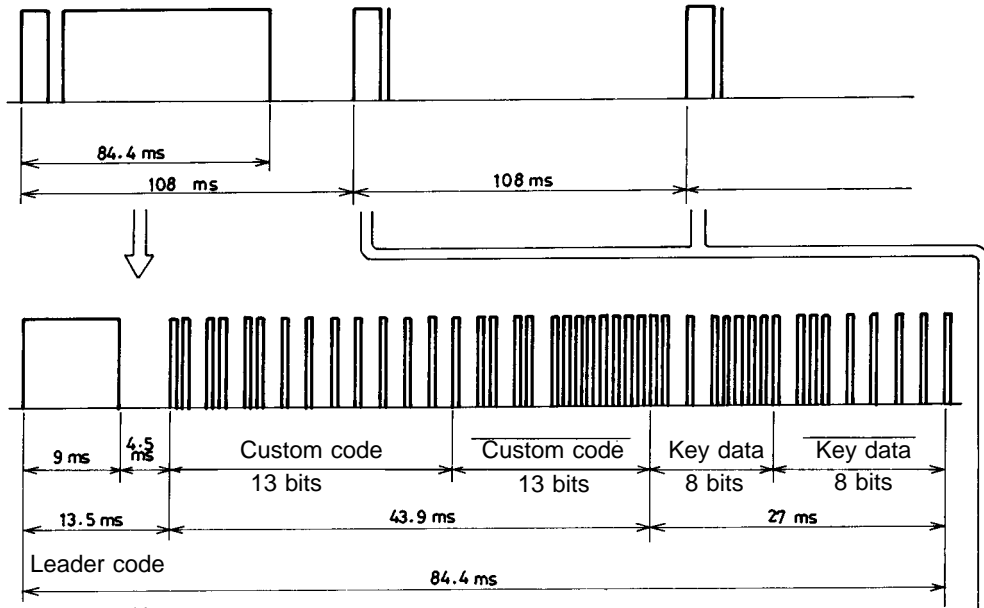
When multi-press of key No.20 and one of key No.21, 22, 23 is done, multi-bit  $D_5$  will be set to "1", with no priority given in key entry.



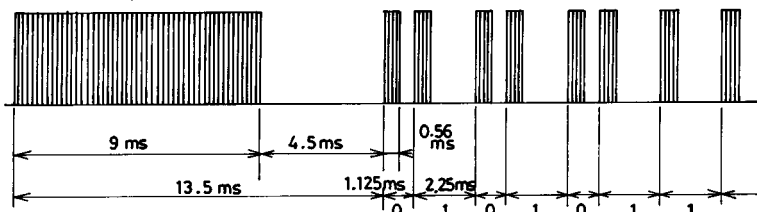
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## 4. Transmit waveforms

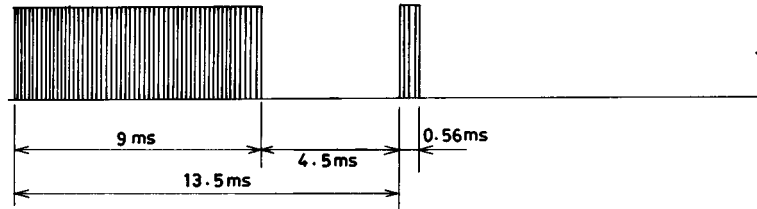
The period of time shown below is for  $f_{OSC} = 455 \text{ kHz}$ .



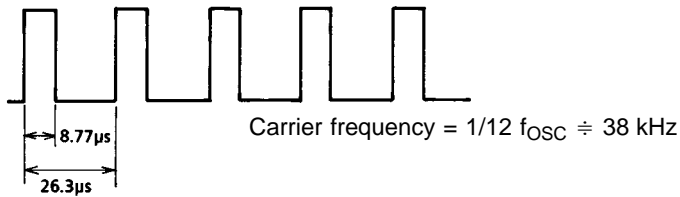
- First time



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

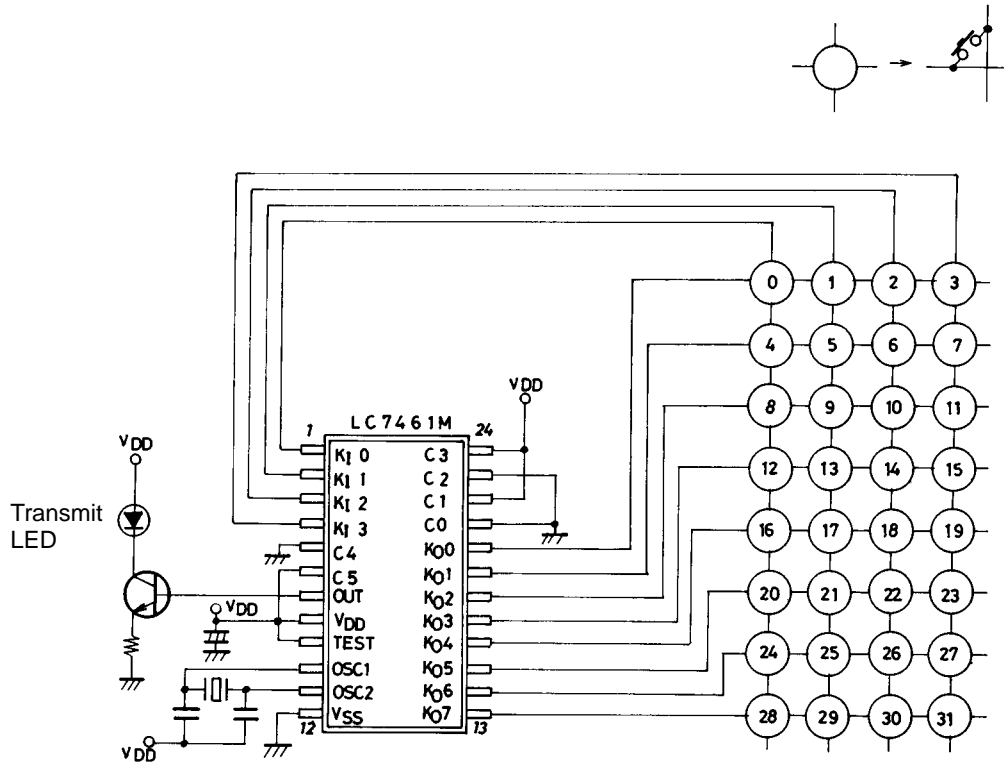


- Carrier waveform



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## Sample Application Circuit



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

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