

### Feature

- Operating voltage: 2.0V ~ 5.0V
- Eight data key control
- Two custom codes for product differentiation
- Start oscillation after key press for power saving
- LED output to indicate transmission status
- Direct 38kHz output frequency infrared LED modulation
- Signal gap time:  $T = 4 \times 192 \times (1/455\text{kHz}) \approx 4 \times 16 \times (1/38\text{kHz})$ 
  - Signal gap time: 4T
- Low power consumption
- 16-Pin DIP/NSOP package

### General Description

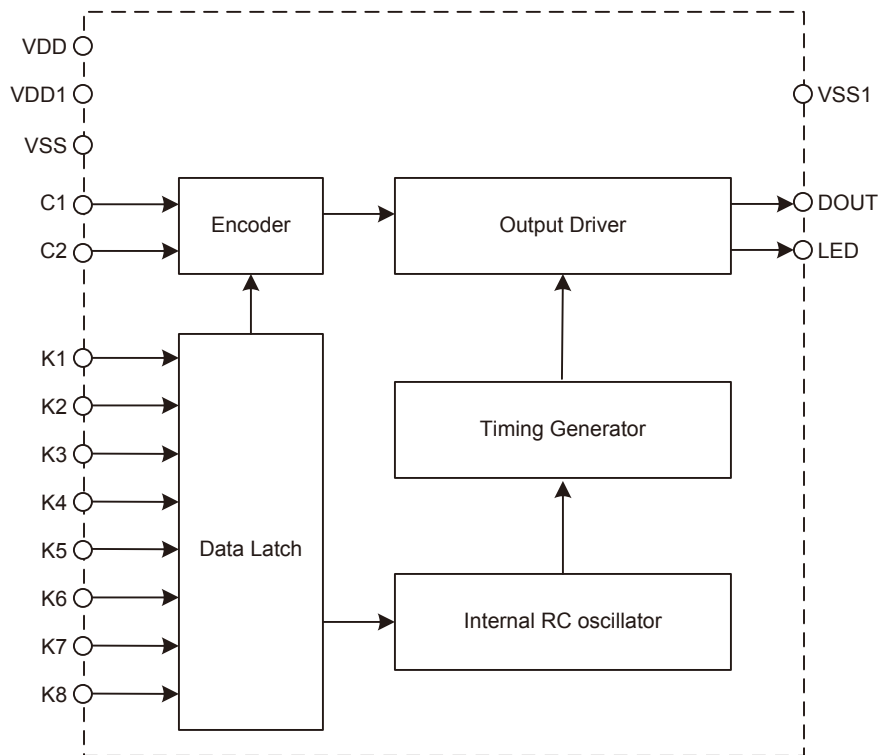
The HT62104 devices are high performance infrared remote control encoders which are manufactured in silicon gate CMOS technology. The HT62104 devices support eight data key inputs and an LED output to indicate the transmission status. A signal transmission is automatically activated when any key data input lines change status from high to low.

The device generates a signal which is composed of a Start code, a Custom code and a Data code and sends the signal to its output pin. This can be provided to an IR (38kHz carrier) transmission medium.

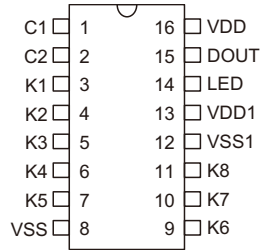
### Applications

- Fan remote controls
- Audio remote controls
- Toy remote controls
- Consumer products remote controls

### Block Diagram



### Pin Assignment

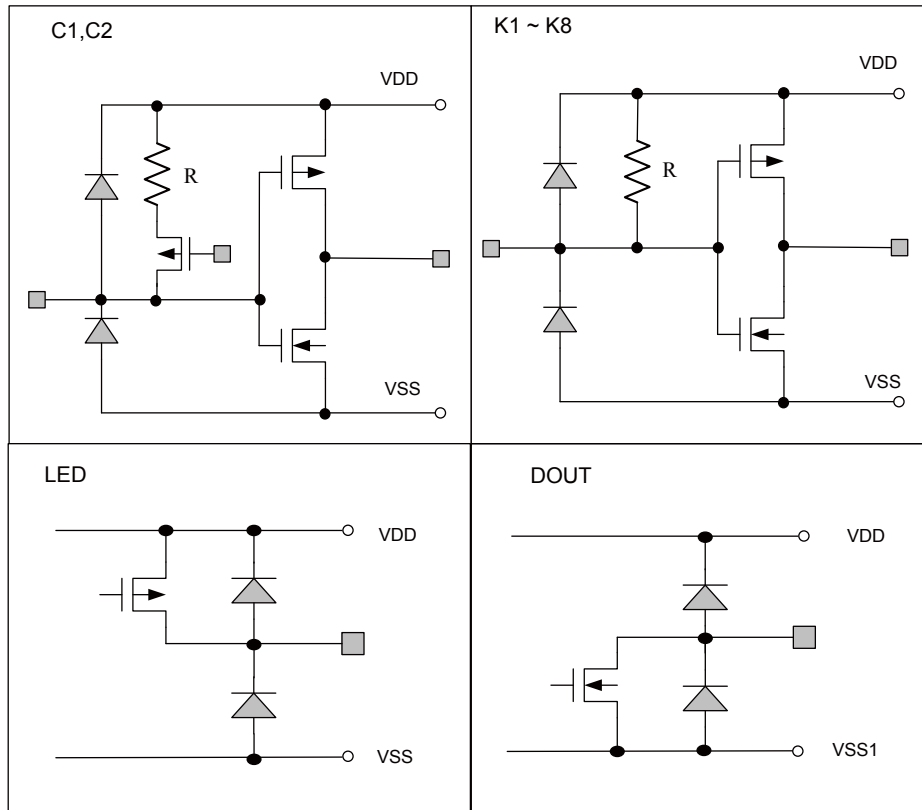


HT62104  
16 DIP-A/NSOP-A

### Pin Description

Pin Name	Type	Description
VDD/VDD1	—	Logic circuit positive power supply.
VSS	—	Logic circuit negative power supply, ground.
VSS1	—	IR-LED negative power supply
C1, C2	I	Custom code inputs.
K1~K8	I	Remote control key inputs. Internally connected to pull-high resistors.
DOUT	O	Serial data output. NMOS open-drain structure.
LED	O	Transmission indicator. PMOS open-drain structure.

### Approximate Internal Connections



## Absolute Maximum Ratings

Supply Voltage.....	$V_{SS}-0.3V$ to $V_{SS}+6.5V$	Storage Temperature .....	$-55^{\circ}C$ to $150^{\circ}C$
Input Voltage.....	$V_{SS}-0.3V$ to $V_{DD}+0.3V$	Operating Temperature .....	$-10^{\circ}C$ to $70^{\circ}C$
Output Voltage.....	$V_{SS}-0.3V$ to $V_{DD}+0.3V$		

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.

## Electrical Characteristics

 $T_a = 25^{\circ}C$ 

Symbol	Parameter	Test Condition		Min.	Typ.	Max.	Unit
		VDD	Condition				
$V_{DD}$	Operating Voltage	—	—	2.0	—	5.0	V
$I_{DD}$	Operating Current	3V	No load, C1 and C2 pins floating	—	0.6	0.9	mA
$I_{STB}$	Standby Current	3V	No load, Input pins floating, Oscillator stops	—	0.1	1.0	$\mu A$
$V_{IH}$	Input High Voltage (C1~C2, K1~K8)	3V	—	2.1	—	—	V
$V_{IL}$	Input Low Voltage (C1~C2, K1~K8)	3V	—	—	—	0.9	V
$R_{PH1}$	Pull-high Resistor (C1~C2)	3V	—	25	50	75	k $\Omega$
$R_{PH2}$	Pull-high Resistor (K1~K8)	3V	—	500	900	1500	k $\Omega$
$I_{OH}$	LED Pin Output Source Current	3V	$V_{OH} = 2.7V$	-2	—	-5	mA
$I_{OL}$	DOUT Pin Output Sink Current	3V	$V_{OL} = 0.6V$	300	350	—	mA
$t_{DW}$	Single Data Bit Width	2.0V~3.6V	$T_a = 25^{\circ}C$ , load=1k $\Omega$ for DOUNT pin	Typ. - 1.5%	1.688	Typ. + 1.5%	ms
			$0^{\circ}C < T_a = 25^{\circ}C < 50^{\circ}C$ , load=1k $\Omega$ for DOUNT pin	Typ. - 2.3%	1.688	Typ. + 2.3%	ms

## Functional Description

The HT62104 Infrared remote control encoder provides a means for easy remote control signal encoding. As all functions, including the system oscillator, are integrated within the device, the addition of external switches and an IR LED is all that is required to implement a full Infrared remote control transmitter function.

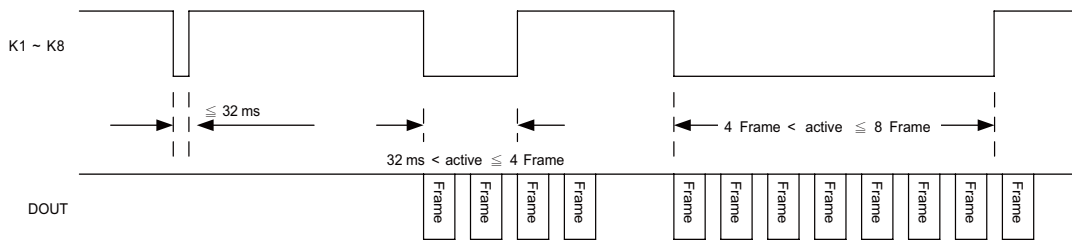
The device will generate an encoded signal on its output pin, DOUT, composed of a Start code, a Custom code and a Data code. The signal is automatically generated on the DOUT pin when any data input pin, K1~K8, changes state from high to low. The internal pull-high resistors keep these data input pins in a normally high condition. The output signal on the DOUT pin can be interfaced to an external IR LED for wireless signal transmission.

## Signal Generation

The device will encode and transmit a Start code, a Custom code and a Data code upon receipt of a trigger signal. The trigger signal is a high to low transition on any of the data input pins, K1~K8. The pins are normally kept at a high level by the internal pull-high resistors.

### Key Input Trigger

The Signal transmission is initiated when any of the key data input pins changes state from high to low. If the pulse width of the trigger signal derived from the key inputs, K1~K8, is less than or equal to 32ms, there will be no signal output on the DOUT pin. If the pulse width of the trigger signal is greater than 32ms and less than or equal to 4-frame widths, then a frame code repeated 4 times, depending upon which key input is pulled from a high state to a low state, will be generated on the DOUT pin. If the triggered signal pulse width is greater than 4-frame widths and less than or equal to 8-frame widths, then a frame code will be generated and repeated 8 times on the DOUT pin.



Note: 1. The key data input low signal pulse width must be greater than a 32ms duration for a full signal transmission, which consists of a specific repeated frame code, to occur. If the input low signal is less than or equal to 32ms, then no signal will be transmitted.

2. “Frame” indicates a specific frame code which is determined by the triggering key.

## Frame Format

There are four frames that the encoder generates for each available sending trigger. The frame code contains three fields including a 3-bit Start code (S2, S1, S0), a 2-bit Custom code (C1, C2) and a 7-bit Data code (D6, D5, D4, D3, D2, D1, D0). Each key data input corresponds to a specific transmission code shown in the following table.

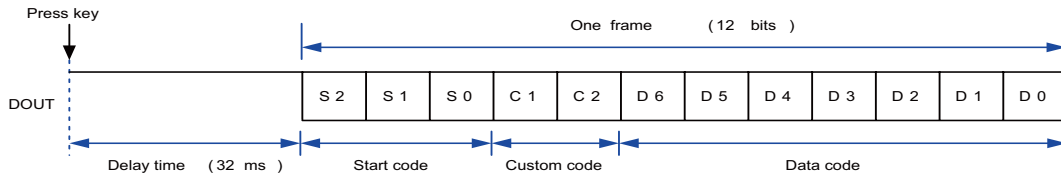
Frame Code Table

Key	Start Code (S)			Custom Code (C)		Data Code (D)						
	S2	S1	S0	C1	C2	D6	D5	D4	D3	D2	D1	D0
K1	1	1	0	C1	C2	0	0	0	0	0	0	1
K2	1	1	0	C1	C2	0	0	0	0	0	1	0
K3	1	1	0	C1	C2	0	0	0	0	1	0	0
K4	1	1	0	C1	C2	0	0	0	1	0	0	0
K5	1	1	0	C1	C2	0	0	1	0	0	0	0
K6	1	1	0	C1	C2	0	1	0	0	0	0	0
K7	1	1	0	C1	C2	1	0	0	0	0	1	1
K8	1	1	0	C1	C2	1	0	0	0	1	1	0

The C1 and C2 pins are internally connected to pull-high resistors whose status are decided by customers. Connecting to GND represents a “0” while connecting to VDD or keeping in a floating state represents a “1”.

**Frame Data Format On DOUT Pin**

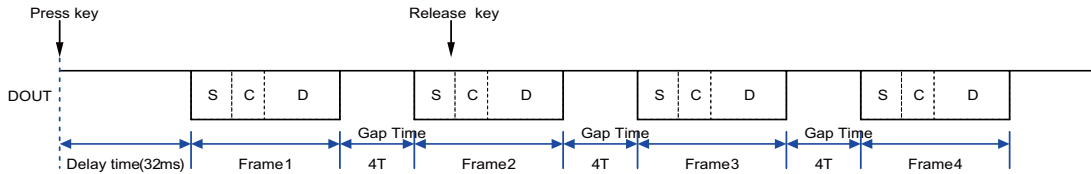
- A one Frame data format is shown below.



- The time duration between Frame (n) and Frame (n+1) is called the Signal Gap Time. The Gap Time is counted based on a unit period, denoted as “T”.

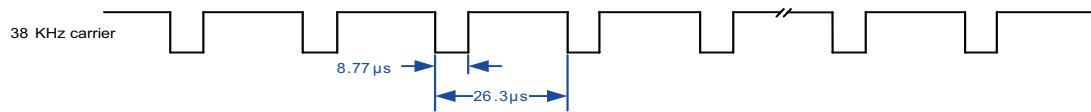
$$1T = 4\lambda = 4 \times 192 \times \frac{1}{455 \text{ kHz}} \approx 4 \times 16 \times \frac{1}{38 \text{ kHz}}$$

- For the HT62104 device, the Signal Gap Time is 4T.



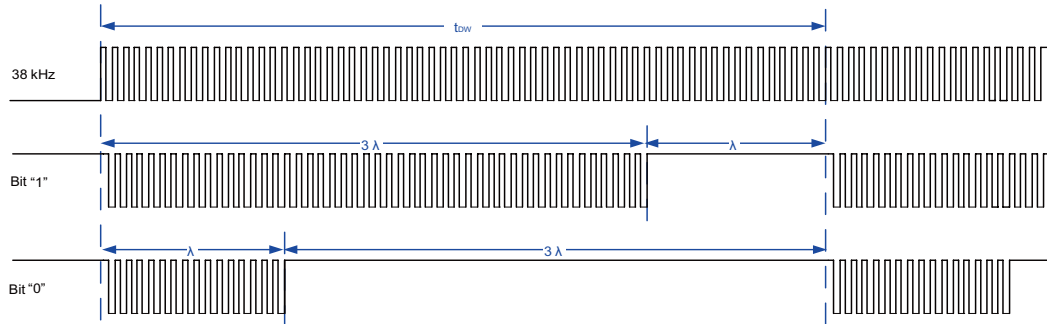
**Carrier Output Waveform**

The carrier signal, with a frequency of 38kHz, is superimposed onto the output data signal which is used to generate and data 0 and data 1 waveforms. The carrier signal is shown in the following diagram.



**DOUT Pin Bit Code Waveforms**

As bits can be designated as either “0” or “1”, they must be encoded in a certain way as shown below.



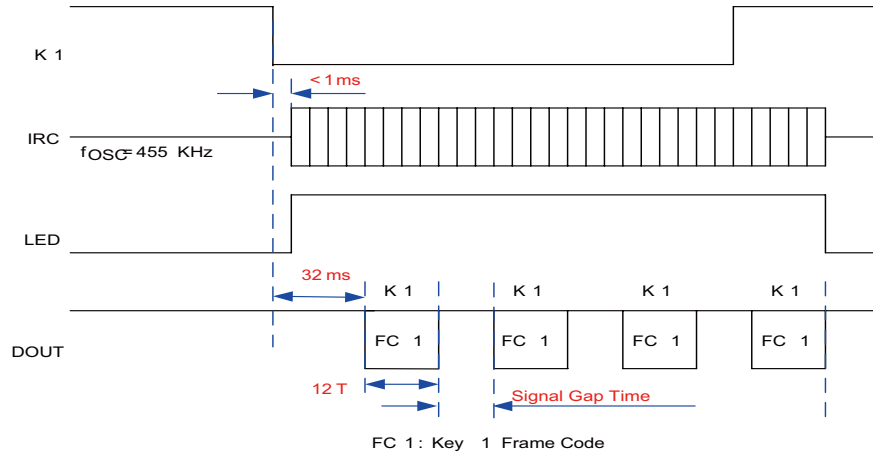
Note: 1.  $1\lambda = 192 \times \frac{1}{455 \text{ kHz}} \approx 16 \times \frac{1}{38 \text{ kHz}}$

2. Bit “1” consists of a “high” pulse for  $1\lambda$  and a “38kHz carrier” for  $3\lambda$ .
3. Bit “0” consists of a “high” pulse for  $3\lambda$  and a “38kHz carrier” for  $1\lambda$ .

### Frame Code Transmission

#### Frame Code Transmission Timing

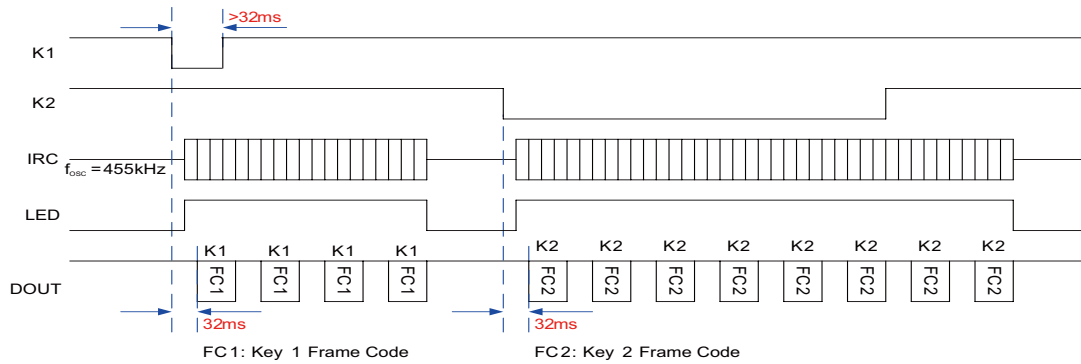
When a key input trigger occurs, the corresponding frame code will be output on the DOUT pin and the frame code will be repeated 4 times. A data “1” will also appear on the LED pin after the internal RC oscillator starts to oscillate.



Frame Code Transmission Timing

#### Sequential Key Input Transmission

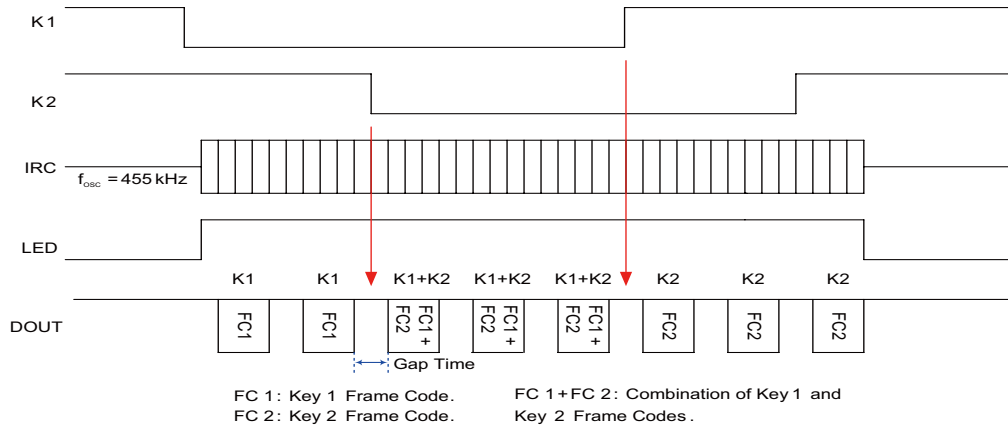
When key input triggers occurs sequentially, the corresponding frame codes will be a sequential output on the DOUT pin. The transmission waveform is shown in the following diagram.



Sequential Key Input Transmission

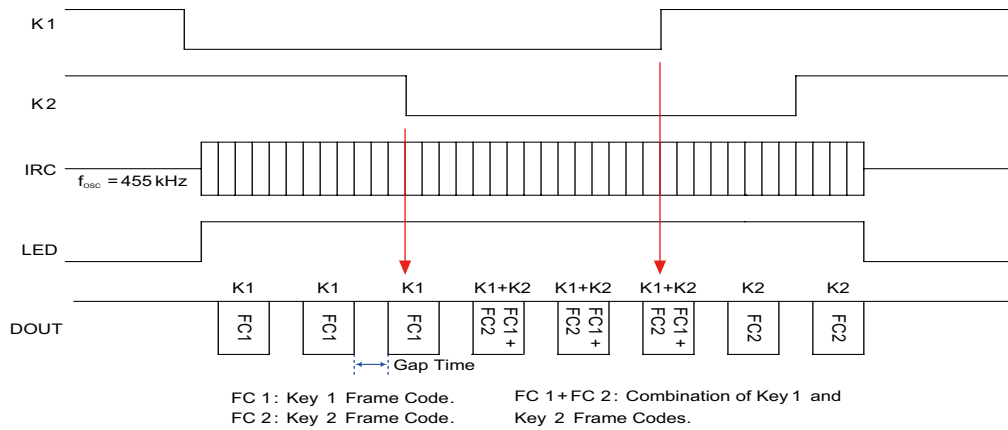
**Overlapped Key Input Transmission**

When two key input trigger pulses overlap, the time where the second trigger pulse occurs will determine what frame code will be output on the DOUT pin. If the second trigger pulse occurs during the gap time, the following frame code will be output on the DOUT pin and will be a combination of the two triggered frame codes. The following diagram shows the transmission waveform.



**Overlapping Key Inputs Occurring During the Gap Time**

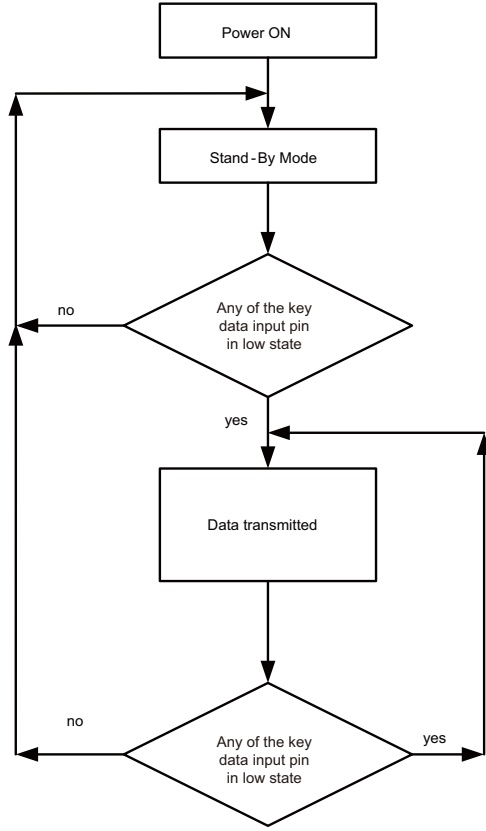
If the second available trigger pulse occurs during the frame code transmission duration, the present frame code being transmitted will still be output on the DOUT pin. Here the combination of the two triggered frame codes will be consecutively output. The following diagram indicates the transmission waveform.



**Overlapping Key Inputs Occurring During a Frame Code Transmission**

The same methodology can be applied on the rising transition of any available trigger pulses to see how the frame code changes when overlapping key inputs occur.

Operation Flowchart





Application Circuit

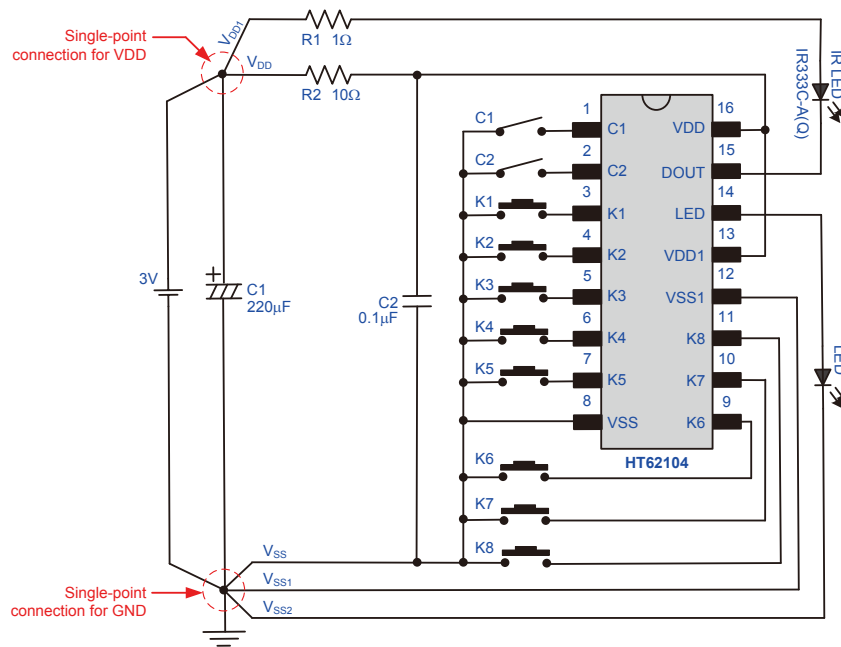


Figure 1 (See Note)

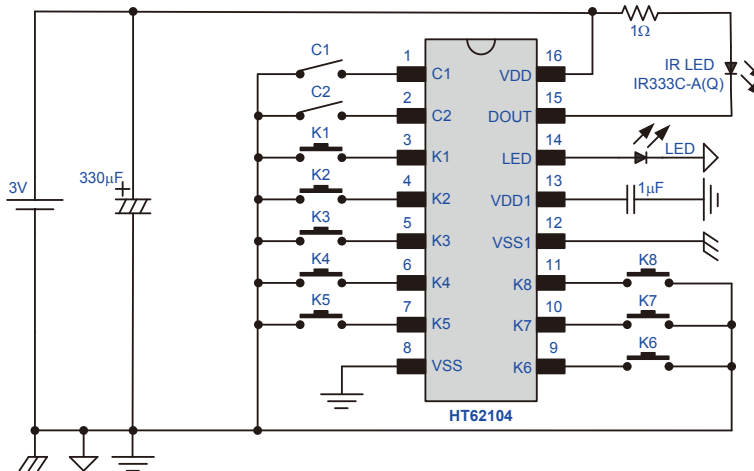


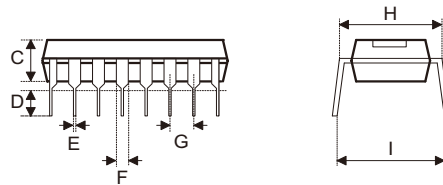
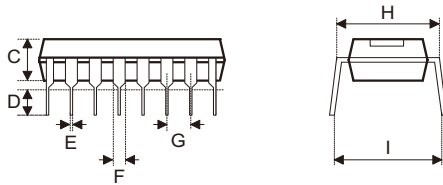
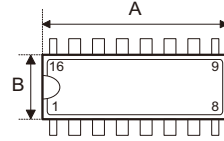
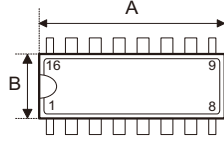
Figure 2

- Note:
1.  $V_{DD1}$  provides power for the IR\_LED;  $V_{DD}$  provides power for the IC logic circuits. The two power supplies, the C1 (220 $\mu$ F) positive terminal and the positive terminal of the battery must have a single-point connection.
  2. Before the  $V_{DD}$  power supply is connected to the IC VDD pin, a capacitor C2 (0.1 $\mu$ F) must first be connected close to the IC.
  3. VSS1 is GND for the DOUT driver; VSS2 is GND for the LED driver; VSS is GND for the IC logic circuits. The three GNDs, the negative terminal of C1 (220 $\mu$ F) and the negative terminal of the battery must have a single-point connection.
  4. If high current drive conditions for IR\_LED result in instability on VDD (noise), it is recommend to add a resistor R2 to stabilise VDD and VDD1 pins.
  5. The DOUT and KEY tracks should be kept apart by a distance of 30mil or more.
  6. During PCB manufacture, the DOUT, VDD, VSS, VSS1, and VSS2 tracks should not be made using carbon tracks.

## Package Information

Note that the package information provided here is for consultation purposes only. As this information may be updated at regular intervals users are reminded to consult the Holtek website (<http://www.holtek.com.tw/english/literature/package.pdf>) for the latest version of the package information.

### 16-pin DIP (300mil) Outline Dimensions


**Fig1. Full Lead Packages**
**Fig2. 1/2 Lead Packages**
**MS-001d (see fig1)**

Symbol	Dimensions in inch		
	Min.	Nom.	Max.
A	0.780	—	0.880
B	0.240	—	0.280
C	0.115	—	0.195
D	0.115	—	0.150
E	0.014	—	0.022
F	0.045	—	0.070
G	—	0.100	—
H	0.300	—	0.325
I	—	0.430	—

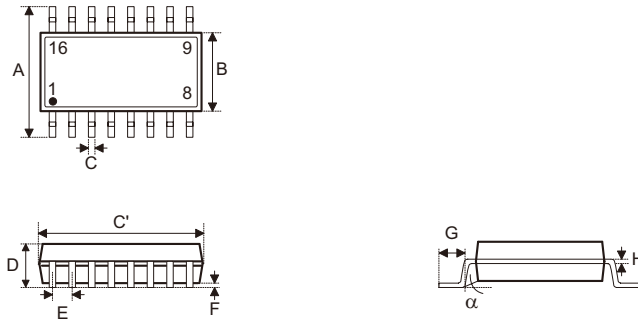
Symbol	Dimensions in mm		
	Min.	Nom.	Max.
A	19.81	—	22.35
B	6.10	—	7.11
C	2.92	—	4.95
D	2.92	—	3.81
E	0.36	—	0.56
F	1.14	—	1.78
G	—	2.54	—
H	7.62	—	8.26
I	—	10.92	—

**MS-001d (see fig2)**

Symbol	Dimensions in inch		
	Min.	Nom.	Max.
A	0.735	—	0.775
B	0.240	—	0.280
C	0.115	—	0.195
D	0.115	—	0.150
E	0.014	—	0.022
F	0.045	—	0.070
G	—	0.100	—
H	0.300	—	0.325
I	—	0.430	—

Symbol	Dimensions in mm		
	Min.	Nom.	Max.
A	18.67	—	19.69
B	6.10	—	7.11
C	2.92	—	4.95
D	2.92	—	3.81
E	0.36	—	0.56
F	1.14	—	1.78
G	—	2.54	—
H	7.62	—	8.26
I	—	10.92	—

16-pin NSOP (150mil) Outline Dimensions

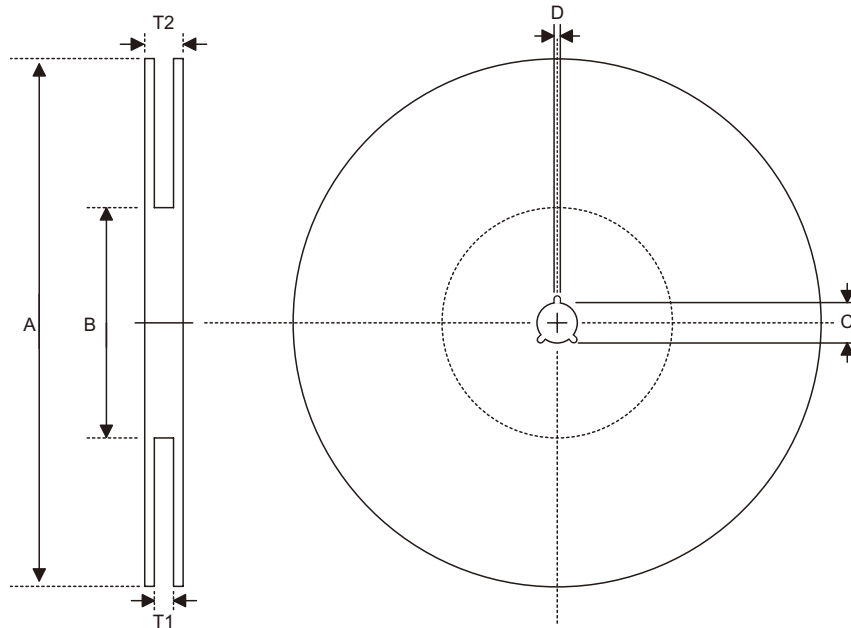


MS-012

Symbol	Dimensions in inch		
	Min.	Nom.	Max.
A	0.228	—	0.244
B	0.150	—	0.157
C	0.012	—	0.020
C'	0.386	—	0.402
D	—	—	0.069
E	—	0.050	—
F	0.004	—	0.010
G	0.016	—	0.050
H	0.007	—	0.010
α	0°	—	8°

Symbol	Dimensions in mm		
	Min.	Nom.	Max.
A	5.79	—	6.20
B	3.81	—	3.99
C	0.30	—	0.51
C'	9.80	—	10.21
D	—	—	1.75
E	—	1.27	—
F	0.10	—	0.25
G	0.41	—	1.27
H	0.18	—	0.25
α	0°	—	8°

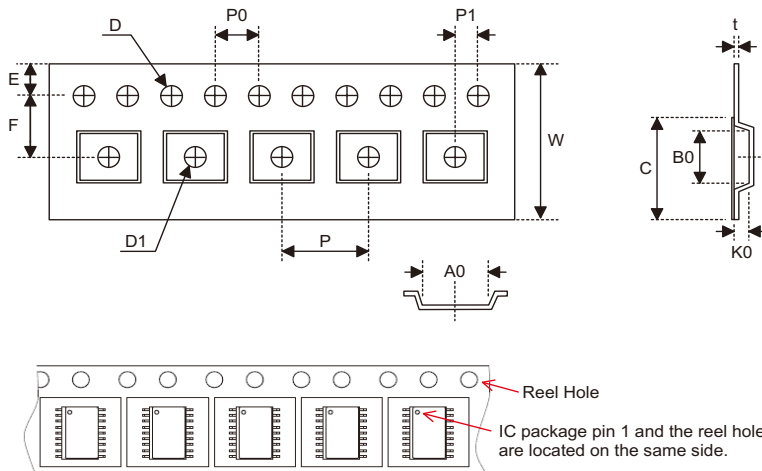
Reel Dimensions



16-pin NSOP (150mil)

Symbol	Description	Dimensions in mm
A	Reel Outer Diameter	330.0±1.0
B	Reel Inner Diameter	100.0±1.5
C	Spindle Hole Diameter	13.0 <sup>+0.5/-0.2</sup>
D	Key Slit Width	2.0±0.5
T1	Space Between Flange	16.8 <sup>+0.3/-0.2</sup>
T2	Reel Thickness	22.2±0.2

Carrier Tape Dimensions



16-pin NSOP (150mil)

Symbol	Description	Dimensions in mm
W	Carrier Tape Width	16.0±0.3
P	Cavity Pitch	8.0±0.1
E	Perforation Position	1.75±0.10
F	Cavity to Perforation (Width Direction)	7.5±0.1
D	Perforation Diameter	1.55 <sup>+0.15/-0.00</sup>
D1	Cavity Hole Diameter	1.50 <sup>+0.25/-0.00</sup>
P0	Perforation Pitch	4.0±0.1
P1	Cavity to Perforation (Length Direction)	2.0±0.1
A0	Cavity Length	6.5±0.1
B0	Cavity Width	10.3±0.1
K0	Cavity Depth	2.1±0.1
t	Carrier Tape Thickness	0.30±0.05
C	Cover Tape Width	13.3±0.1

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