# HD74HC4024

7-stage Binary Counter

REJ03D0325-0300
Rev.3.00
Mar 30, 2006

## Description

The HD74HC4024 is a 7-stage counter. This device is incremented on the falling edge (negative transition) of the input clock, and all its output is reset to a low level by applying a logical high on its reset input.

## Features

- High Speed Operation: $t_{pd}$ (Clock to $Q_1$) = 14 ns typ ($C_L$ = 50 pF)
- High Output Current: Fanout of 10 LSTTL Loads
- Wide Operating Voltage: $V_{CC}$ = 2 to 6 V
- Low Input Current: 1 µA max
- Low Quiescent Supply Current: $I_{CC}$ (static) = 4 µA max (Ta = 25°C)
- Ordering Information

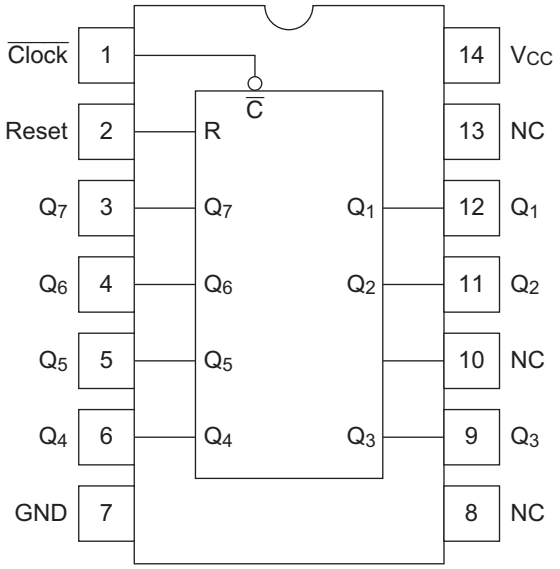
| Part Name | Package Type | Package Code (Previous Code) | Package Abbreviation | Taping Abbreviation (Quantity) |
|---|---|---|---|---|
| HD74HC4024P | DILP-14 pin | PRDP0014AB-B (DP-14AV) | P | — |
| HD74HC4024FPEL | SOP-14 pin (JEITA) | PRSP0014DF-B (FP-14DAV) | FP | EL (2,000 pcs/reel) |
| HD74HC4024RPEL | SOP-14 pin (JEDEC) | PRSP0014DE-A (FP-14DNV) | RP | EL (2,500 pcs/reel) |

Note: Please consult the sales office for the above package availability.

## Function Table

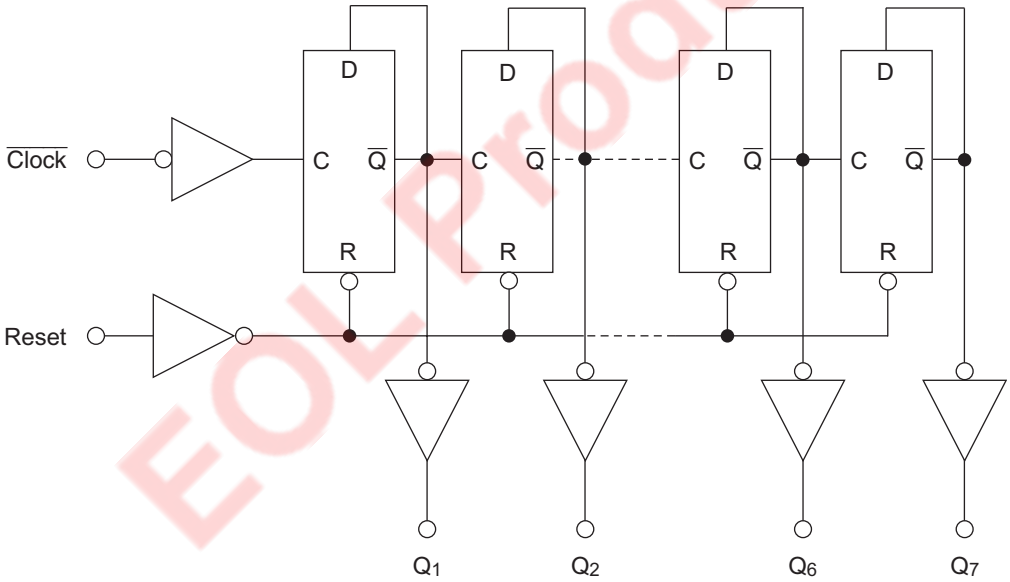
| $\overline{\text{Clock}}$ | Reset | Outputs State |
|---|---|---|
| L | L | No change |
| L | H | All outputs are low |
| H | L | No change |
| H | H | All outputs are low |
| ↓ | L | No change |
| ↓ | H | All outputs are low |
| ↑ | L | Advance to next state |
| ↑ | H | All outputs are low |

## Pin Arrangement




(Top view)

## Block Diagram



## Absolute Maximum Ratings

| Item | Symbol | Ratings | Unit |
|---|---|---|---|
| Supply voltage range | $V_{CC}$ | –0.5 to 7.0 | V |
| Input / Output voltage | $V_{IN}$, $V_{OUT}$ | –0.5 to $V_{CC}$ +0.5 | V |
| Input / Output diode current | $I_{IK}$, $I_{OK}$ | ±20 | mA |
| Output current | $I_{OUT}$ | ±25 | mA |
| $V_{CC}$, GND current | $I_{CC}$ or $I_{GND}$ | ±50 | mA |
| Power dissipation | $P_T$ | 500 | mW |
| Storage temperature | Tstg | –65 to +150 | °C |

Note: The absolute maximum ratings are values, which must not individually be exceeded, and furthermore, no two of which may be realized at the same time.

## Recommended Operating Conditions

| Item | Symbol | Ratings | Unit | Conditions |
|---|---|---|---|---|
| Supply voltage | $V_{CC}$ | 2 to 6 | V | |
| Input / Output voltage | $V_{IN}$, $V_{OUT}$ | 0 to $V_{CC}$ | V | |
| Operating temperature | Ta | –40 to 85 | °C | |
| Input rise / fall time*1 | $t_r$, $t_f$ | 0 to 1000 | ns | $V_{CC}$ = 2.0 V |
| | | 0 to 500 | | $V_{CC}$ = 4.5 V |
| | | 0 to 400 | | $V_{CC}$ = 6.0 V |

Note: 1. This item guarantees maximum limit when one input switches.
Waveform: Refer to test circuit of switching characteristics.

## DC Characteristics

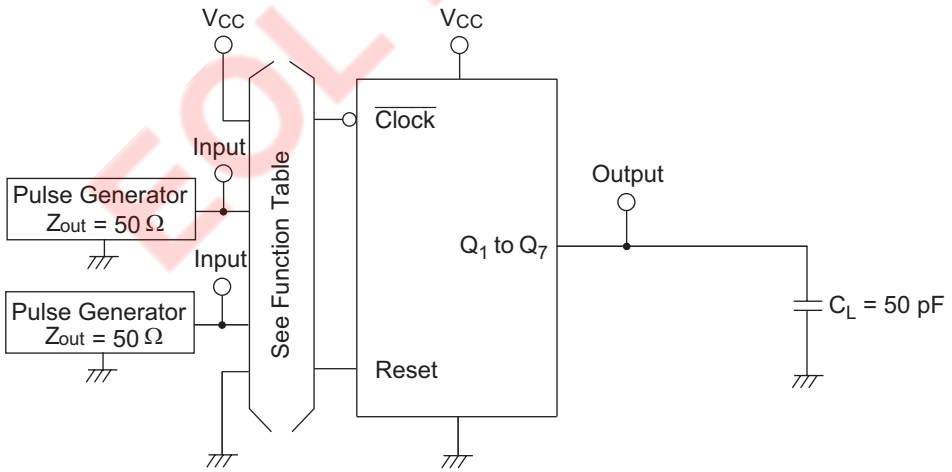
| Item | Symbol | $V_{CC}$ (V) | Ta = 25°C | | | Ta = –40 to +85°C | | Unit | Test Conditions | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | Min | Max | | | |
| Input voltage | $V_{IH}$ | 2.0 | 1.5 | — | — | 1.5 | — | V | | |
| | | 4.5 | 3.15 | — | — | 3.15 | — | | | |
| | | 6.0 | 4.2 | — | — | 4.2 | — | | | |
| | $V_{IL}$ | 2.0 | — | — | 0.5 | — | 0.5 | V | | |
| | | 4.5 | — | — | 1.35 | — | 1.35 | | | |
| | | 6.0 | — | — | 1.8 | — | 1.8 | | | |
| Output voltage | $V_{OH}$ | 2.0 | 1.9 | 2.0 | — | 1.9 | — | V | Vin = $V_{IH}$ or $V_{IL}$ | $I_{OH}$ = –20 µA |
| | | 4.5 | 4.4 | 4.5 | — | 4.4 | — | | | |
| | | 6.0 | 5.9 | 6.0 | — | 5.9 | — | | | |
| | | 4.5 | 4.18 | — | — | 4.13 | — | | | $I_{OH}$ = –4 mA |
| | | 6.0 | 5.68 | — | — | 5.63 | — | | | $I_{OH}$ = –5.2 mA |
| | $V_{OL}$ | 2.0 | — | 0.0 | 0.1 | — | 0.1 | V | Vin = $V_{IH}$ or $V_{IL}$ | $I_{OL}$ = 20 µA |
| | | 4.5 | — | 0.0 | 0.1 | — | 0.1 | | | |
| | | 6.0 | — | 0.0 | 0.1 | — | 0.1 | | | |
| | | 4.5 | — | — | 0.26 | — | 0.33 | | | $I_{OL}$ = 4 mA |
| | | 6.0 | — | — | 0.26 | — | 0.33 | | | $I_{OL}$ = 5.2 mA |
| Input current | Iin | 6.0 | — | — | ±0.1 | — | ±1.0 | µA | Vin = $V_{CC}$ or GND | |
| Quiescent supply current | $I_{CC}$ | 6.0 | — | — | 4.0 | — | 40 | µA | Vin = $V_{CC}$ or GND, Iout = 0 µA | |

## AC Characteristics

($C_L$ = 50 pF, Input $t_r$ = $t_f$ = 6 ns)

| Item | Symbol | $V_{CC}$ (V) | Ta = 25°C | | | Ta = –40 to +85°C | | Unit | Test Conditions |
|---|---|---|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | Min | Max | | |
| Maximum clock frequency | $f_{max}$ | 2.0 | — | — | 5 | — | 4 | MHz | |
| | | 4.5 | — | — | 25 | — | 20 | | |
| | | 6.0 | — | — | 29 | — | 24 | | |
| Propagation delay time | $t_{PLH}$ | 2.0 | — | — | 185 | — | 230 | ns | Clock to $Q_1$ |
| | | 4.5 | — | 14 | 37 | — | 46 | | |
| | | 6.0 | — | — | 31 | — | 39 | | |
| | $t_{PHL}$ | 2.0 | — | — | 185 | — | 230 | ns | Clock to $Q_1$ |
| | | 4.5 | — | 14 | 37 | — | 46 | | |
| | | 6.0 | — | — | 31 | — | 39 | | |
| | $t_{PHL}$ | 2.0 | — | — | 185 | — | 230 | ns | Reset to output |
| | | 4.5 | — | 13 | 37 | — | 46 | | |
| | | 6.0 | — | — | 31 | — | 39 | | |
| Removal time | $t_{rem}$ | 2.0 | 100 | — | — | 125 | — | ns | |
| | | 4.5 | 20 | 0 | — | 25 | — | | |
| | | 6.0 | 17 | — | — | 21 | — | | |
| Pulse width | $t_w$ | 2.0 | 80 | — | — | 100 | — | ns | |
| | | 4.5 | 16 | 4 | — | 20 | — | | |
| | | 6.0 | 14 | — | — | 17 | — | | |
| Output rise/fall time | $t_{TLH}$ $t_{THL}$ | 2.0 | — | — | 75 | — | 95 | ns | |
| | | 4.5 | — | 5 | 15 | — | 19 | | |
| | | 6.0 | — | — | 13 | — | 16 | | |
| Input capacitance | Cin | — | — | — | 5 | 10 | — | 10 | pF | |

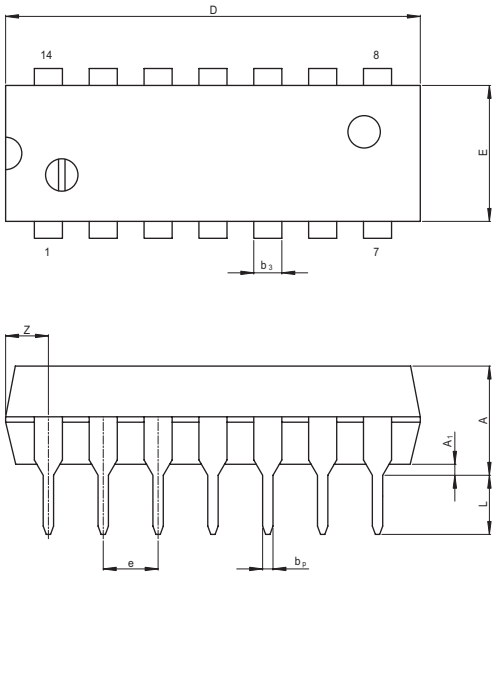
## Test Circuit




Note : 1. $C_L$ includes probe and jig capacitance.

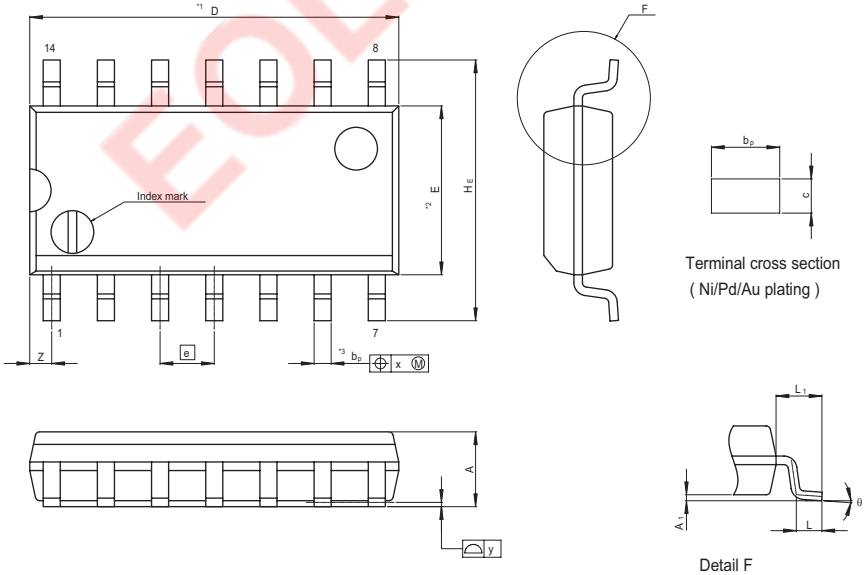
# Package Dimensions

| JEITA Package Code | RENESAS Code | Previous Code | MASS[Typ.] |
|---|---|---|---|
| P-DIP14-6.3x19.2-2.54 | PRDP0014AB-B | DP-14AV | 0.97g |




| Reference Symbol | Dimension in Millimeters | | |
|---|---|---|---|
| | Min | Nom | Max |
| $e_1$ | — | 7.62 | — |
| D | — | 19.2 | 20.32 |
| E | — | 6.3 | 7.4 |
| A | — | — | 5.06 |
| $A_1$ | 0.51 | — | — |
| $b_p$ | 0.40 | 0.48 | 0.56 |
| $b_3$ | — | 1.30 | — |
| c | 0.19 | 0.25 | 0.31 |
| θ | 0° | — | 15° |
| e | 2.29 | 2.54 | 2.79 |
| Z | — | — | 2.39 |
| L | 2.54 | — | — |

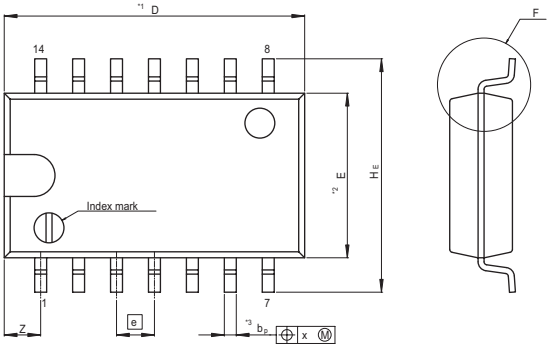
| JEITA Package Code | RENESAS Code | Previous Code | MASS[Typ.] |
|---|---|---|---|
| P-SOP14-3.95x8.65-1.27 | PRSP0014DE-A | FP-14DNV | 0.13g |

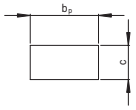



NOTE)
1. DIMENSIONS"*1 (Nom)"AND"*2" DO NOT INCLUDE MOLD FLASH.
2. DIMENSION"*3"DOES NOT INCLUDE TRIM OFFSET.

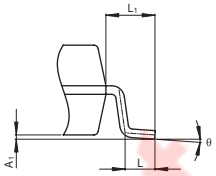
| Reference Symbol | Dimension in Millimeters | | |
|---|---|---|---|
| | Min | Nom | Max |
| D | — | 8.65 | 9.05 |
| E | — | 3.95 | — |
| $A_2$ | — | — | — |
| $A_1$ | 0.10 | 0.14 | 0.25 |
| A | — | — | 1.75 |
| $b_p$ | 0.34 | 0.40 | 0.46 |
| $b_1$ | — | — | — |
| c | 0.15 | 0.20 | 0.25 |
| $c_1$ | — | — | — |
| θ | 0° | — | 8° |
| $H_E$ | 5.80 | 6.10 | 6.20 |
| e | — | 1.27 | — |
| x | — | — | 0.25 |
| y | — | — | 0.15 |
| Z | — | — | 0.635 |
| L | 0.40 | 0.60 | 1.27 |
| $L_1$ | — | 1.08 | — |

| JEITA Package Code | RENESAS Code | Previous Code | MASS[Typ.] |
|---|---|---|---|
| P-SOP14-5.5x10.06-1.27 | PRSP0014DF-B | FP-14DAV | 0.23g |




Terminal cross section
( Ni/Pd/Au plating )




Detail F

NOTE)
1. DIMENSIONS"*1 (Nom)"AND"*2" DO NOT INCLUDE MOLD FLASH.
2. DIMENSION"*3"DOES NOT INCLUDE TRIM OFFSET.

| Reference Symbol | Dimension in Millimeters | | |
|---|---|---|---|
| | Min | Nom | Max |
| D | — | 10.06 | 10.5 |
| E | — | 5.50 | — |
| $A_2$ | — | — | — |
| $A_1$ | 0.00 | 0.10 | 0.20 |
| A | — | — | 2.20 |
| $b_p$ | 0.34 | 0.40 | 0.46 |
| $b_1$ | — | — | — |
| c | 0.15 | 0.20 | 0.25 |
| $c_1$ | — | — | — |
| θ | 0° | — | 8° |
| $H_E$ | 7.50 | 7.80 | 8.00 |
| e | — | 1.27 | — |
| x | — | — | 0.12 |
| y | — | — | 0.15 |
| Z | — | — | 1.42 |
| L | 0.50 | 0.70 | 0.90 |
| $L_1$ | — | 1.15 | — |

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