

# HD74LS74A • Dual D-type Positive Edge-triggered Flip-Flops (with Preset and Clear)

## FUNCTION TABLE

| Inputs |       |       |   | Outputs |             |
|--------|-------|-------|---|---------|-------------|
| Preset | Clear | Clock | D | Q       | $\bar{Q}$   |
| L      | H     | X     | X | H       | L           |
| H      | L     | X     | X | L       | H           |
| L      | L     | X     | X | H*      | H*          |
| H      | H     | ↑     | H | H       | L           |
| H      | H     | ↑     | L | L       | H           |
| H      | H     | L     | X | $Q_0$   | $\bar{Q}_0$ |

Notes) H; high level, L; low level, X; irrelevant

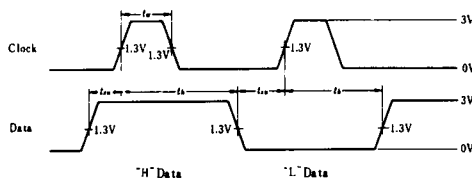
↑; transition from low to high level

$Q_0$ ; level of Q before the indicated steady-state conditions were established.

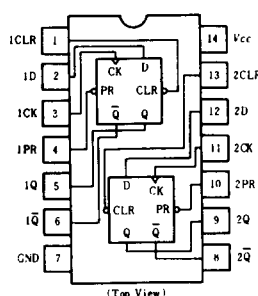
$\bar{Q}_0$ ; complement of  $Q_0$  or level of  $\bar{Q}$  before the indicated steady-state input conditions were established.

\*; This configuration is nonstable, that is, it will not persist when preset and clear inputs return to their inactive (high) level.

## TIMING DEFINITION



## PIN ARRANGEMENT



## RECOMMENDED OPERATING CONDITIONS

| Item            | Symbol       | min | typ | max | Unit |
|-----------------|--------------|-----|-----|-----|------|
| Clock frequency | $f_{clock}$  | 0   | —   | 25  | MHz  |
| Pulse width     | Clock High   | 25  | —   | —   | ns   |
|                 | Clear/Preset | 25  | —   | —   | ns   |
| Setup time      | "H" Data     | 20† | —   | —   | ns   |
|                 | "L" Data     | 20† | —   | —   | ns   |
| Hold time       | $t_h$        | 5†  | —   | —   | ns   |

Note) †; The arrow indicates the rising edge.

## ELECTRICAL CHARACTERISTICS ( $T_a = -20 \sim +75^\circ\text{C}$ )

| Item                         |        | Symbol        | Test Conditions                                                                              |                     | min | typ* | max  | Unit          |
|------------------------------|--------|---------------|----------------------------------------------------------------------------------------------|---------------------|-----|------|------|---------------|
| Input voltage                |        | $V_{IH}$      |                                                                                              |                     | 2.0 | —    | —    | V             |
|                              |        | $V_{IL}$      |                                                                                              |                     | —   | —    | 0.8  | V             |
| Output voltage               |        | $V_{OH}$      | $V_{CC}=4.75\text{V}$ , $V_{IH}=2\text{V}$ , $V_{IL}=0.8\text{V}$ , $I_{OH}=-400\mu\text{A}$ |                     | 2.7 | —    | —    | V             |
|                              |        | $V_{OL}$      | $V_{CC}=4.75\text{V}$ , $V_{IL}=0.8\text{V}$ ,                                               | $I_{OL}=8\text{mA}$ | —   | —    | 0.5  | V             |
|                              |        |               | $V_{IH}=2\text{V}$                                                                           | $I_{OL}=4\text{mA}$ | —   | —    | 0.4  |               |
| Input current                | D      | $I_{IH}$      | $V_{CC}=5.25\text{V}$ , $V_I=2.7\text{V}$                                                    |                     | —   | —    | 20   | $\mu\text{A}$ |
|                              | Clear  |               |                                                                                              |                     | —   | —    | 40   |               |
|                              | Preset |               |                                                                                              |                     | —   | —    | 40   |               |
|                              | Clock  |               |                                                                                              |                     | —   | —    | 20   |               |
|                              | D      | $I_{IL}$      | $V_{CC}=5.25\text{V}$ , $V_I=0.4\text{V}$                                                    |                     | —   | —    | -0.4 | mA            |
|                              | Clear  |               |                                                                                              |                     | —   | —    | -0.8 |               |
|                              | Preset |               |                                                                                              |                     | —   | —    | -0.8 |               |
|                              | Clock  |               |                                                                                              |                     | —   | —    | -0.4 |               |
|                              | D      | $I_I$         | $V_{CC}=5.25\text{V}$ , $V_I=7\text{V}$                                                      |                     | —   | —    | 0.1  | mA            |
|                              | Clear  |               |                                                                                              |                     | —   | —    | 0.2  |               |
|                              | Preset |               |                                                                                              |                     | —   | —    | 0.2  |               |
|                              | Clock  |               |                                                                                              |                     | —   | —    | 0.1  |               |
| Short-circuit output current |        | $I_{OS}$      | $V_{CC}=5.25\text{V}$                                                                        |                     | -20 | —    | -100 | mA            |
| Supply current               |        | $I_{CC}^{**}$ | $V_{CC}=5.25\text{V}$                                                                        |                     | —   | 4    | 8    | mA            |
| Input clamp voltage          |        | $V_{IK}$      | $V_{CC}=4.75\text{V}$ , $I_{IN}=-18\text{mA}$                                                |                     | —   | —    | -1.5 | V             |

\*  $V_{CC} = 5\text{V}$ ,  $T_a = 25^\circ\text{C}$

\*\* With all outputs open,  $I_{CC}$  is measured with the Q and  $\bar{Q}$  outputs high in turn. At the time of measurement, the clock input is grounded.

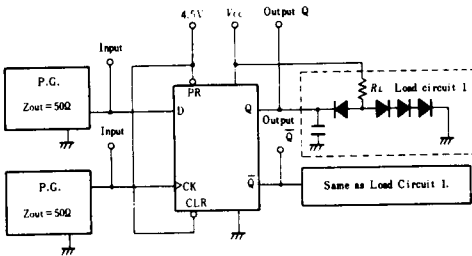
## ■ SWITCHING CHARACTERISTICS ( $V_{CC}=5V$ , $T_a=25^\circ C$ )

| Item                    | Symbol    | Inputs                 | Outputs         | Test Condition              | min | typ | max | Unit |
|-------------------------|-----------|------------------------|-----------------|-----------------------------|-----|-----|-----|------|
| Maximum clock frequency | $f_{max}$ |                        |                 | $C_L=15pF$ , $R_L=2k\Omega$ | 25  | 33  | —   | MHz  |
| Propagation delay time  | $t_{PLH}$ | Clock, Clear or Preset | $Q$ , $\bar{Q}$ |                             | —   | 13  | 25  | ns   |
|                         | $t_{PHL}$ |                        |                 |                             | —   | 25  | 40  | ns   |

## ■ TESTING METHOD

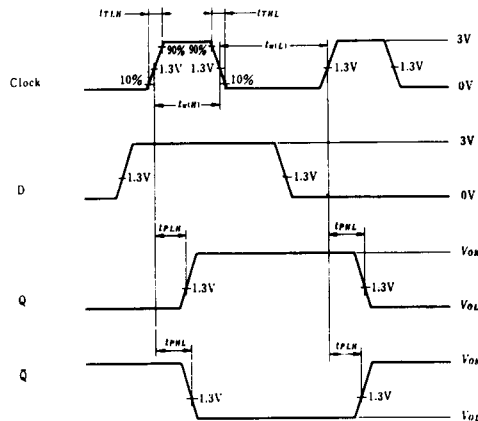
### 1) Test Circuit

1.1)  $f_{max}$ ,  $t_{PLH}$ ,  $t_{PHL}$  (Clock  $\rightarrow Q, \bar{Q}$ )



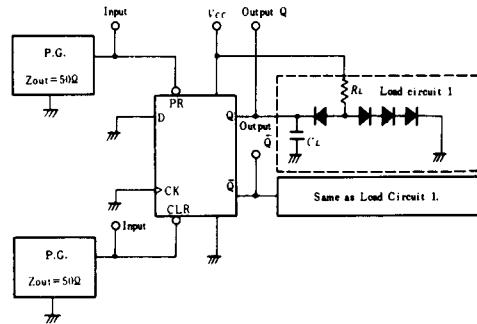
- Notes) 1. Test is put into the each flip-flop  
2. All diodes are 1S2074 (D).  
3.  $C_L$  includes probe and jig capacitance.

### Waveform



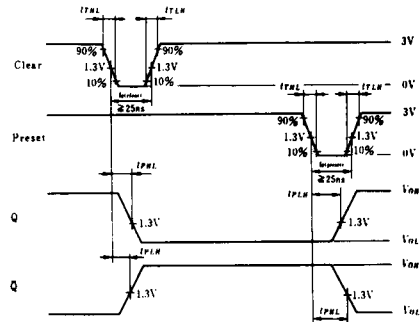
Note) Clock input pulse;  $t_{TLH} \leq 15ns$ ,  
 $t_{THL} \leq 6ns$ ,  $PRR=1MHz$ , duty  
cycle=30% and; for  $f_{max}$ ,  
 $t_{TLH}=t_{THL} \leq 2.5ns$ .

1.2)  $t_{PHL}$ ,  $t_{PLH}$  (Clear or Preset  $\rightarrow Q, \bar{Q}$ )



- Notes) 1. Test is put into the each flip-flop  
2. All diodes are 1S2074 (D).  
3.  $C_L$  includes probe and jig capacitance.

### Waveform



Note) Clear and preset input pulse;  
 $t_{TLH} \leq 15ns$ ,  $t_{THL} \leq 6ns$ ,  
 $PRR=1MHz$

# PACKAGING INFORMATION

T-90-20

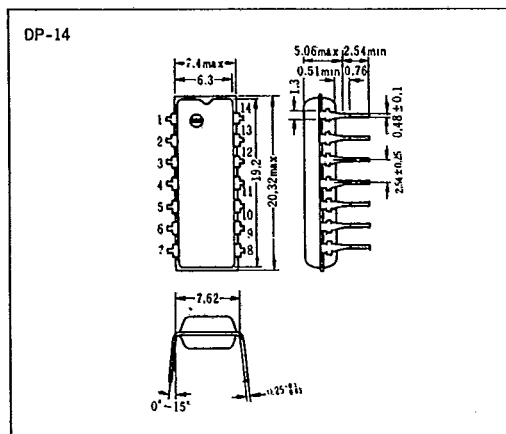
Factory orders for circuits described in this databook should include a three-part type number as explained in the following example.

## HD 74LS00 P

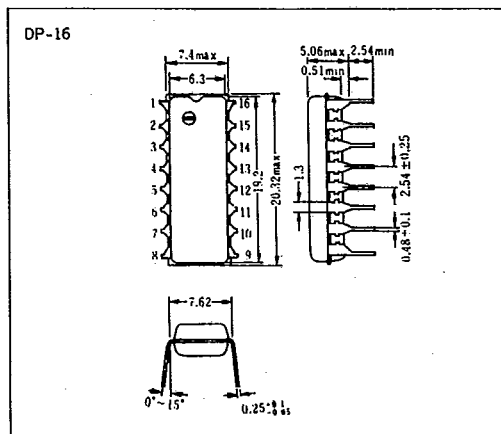
Package ; Plastic DIP ; letters P  
Cerdip ; non-letters  
Circuit description  
Prefix : HD ; Hitachi Digital IC

### ■ Plastic DIP

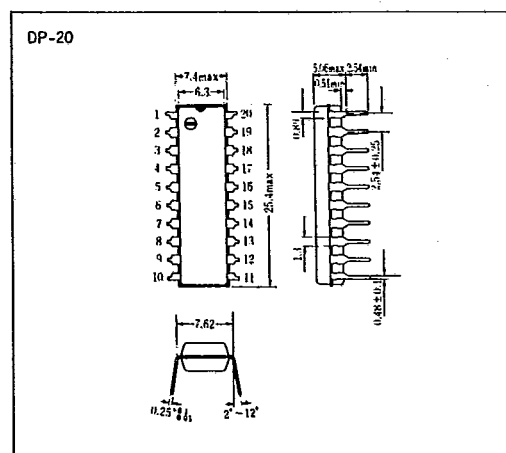
#### ● 14 Pin



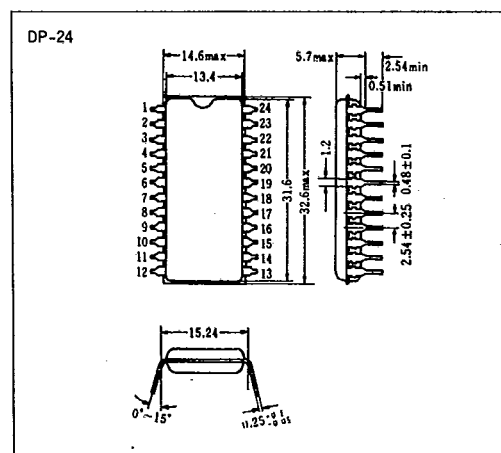
#### ● 16 Pin



#### ● 20 Pin



#### ● 24 Pin



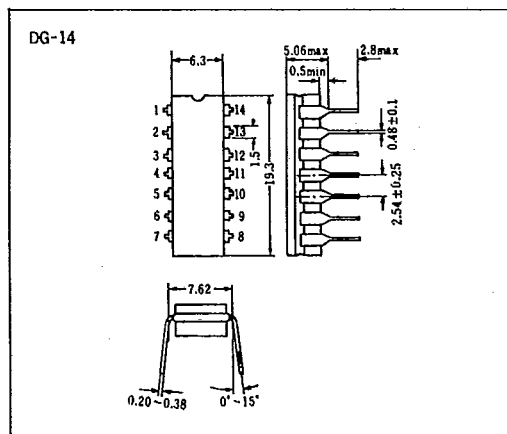
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T-90-20

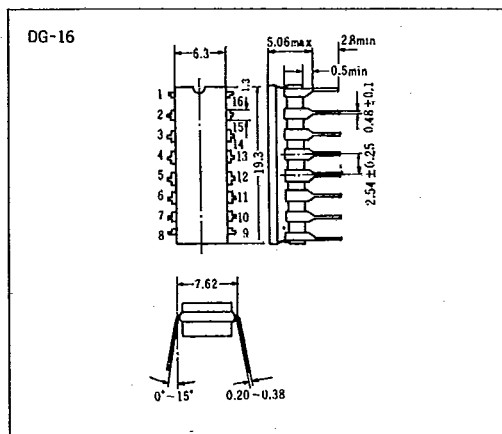
# PACKAGING INFORMATION

## ■Cerdip

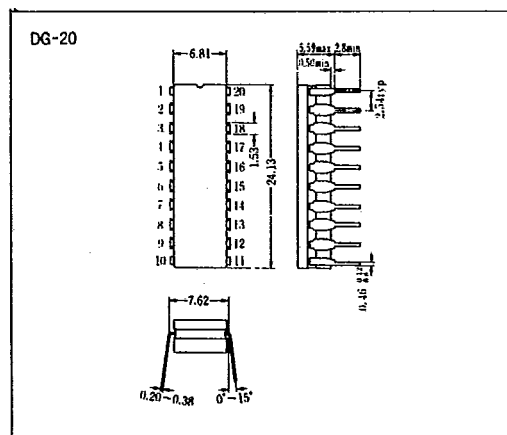
### ●14 Pin



### ●16 Pin



### ●20 Pin



### ●24 Pin

