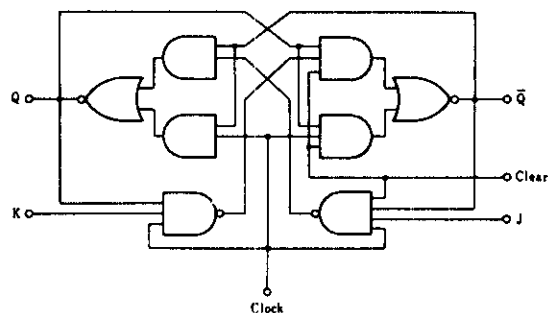
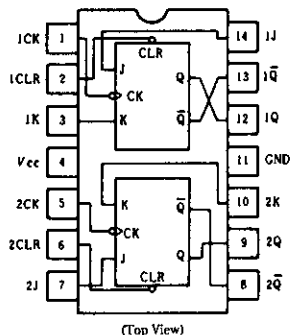


# HD74LS73A • Dual J-K Flip-Flops (with Clear)

## ■ BLOCK DIAGRAM (1/2)



## ■ PIN ARRANGEMENT



## ■ FUNCTION TABLE

| Inputs |       |   |   | Outputs        |                 |
|--------|-------|---|---|----------------|-----------------|
| Clear  | Clock | J | K | Q              | Q̄              |
| L      | X     | X | X | L              | H               |
| H      | ↓     | L | L | Q <sub>0</sub> | Q̄ <sub>0</sub> |
| H      | ↓     | H | L | H              | L               |
| H      | ↓     | L | H | L              | H               |
| H      | ↓     | H | H | Toggle         |                 |
| H      | H     | X | X | Q <sub>0</sub> | Q̄ <sub>0</sub> |

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

↓; transition from high to low level

Q<sub>0</sub>; level of Q before the indicated steady-state input conditions were established.

Q̄<sub>0</sub>; complement of Q<sub>0</sub> or level of Q before the indicated steady-state input conditions were established.

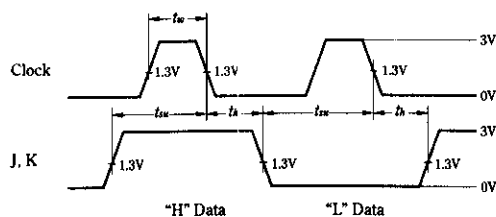
Toggle; each output changes to the complement of its previous level on each active transition indicated by ↓.

## ■ RECOMMENDED OPERATING CONDITION

| Item            | Symbol      | min | typ | max | Unit |
|-----------------|-------------|-----|-----|-----|------|
| Clock frequency | $f_{clock}$ | 0   | —   | 30  | MHz  |
| Pulse width     | Clock High  | 20  | —   | —   | ns   |
|                 | Clear Low   | 25  | —   | —   |      |
| Setup time      | "H" Data    | 20↓ | —   | —   | ns   |
|                 | "L" Data    | 20↓ | —   | —   |      |
| Hold time       | $t_h$       | 0↓  | —   | —   | ns   |

Note) ↓; The arrow indicates the falling edge.

## ■ TIMING DEFINITION



## 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             |
|                              | $V_{OL}$ | $V_{CC}=4.75\text{V}$ , $V_{IH}=2\text{V}$                                                   | —   | —    | 0.5  | V             |
|                              |          | $V_{IL}=0.8\text{V}$                                                                         | —   | —    | 0.4  |               |
| Input current                | J, K     | $I_{IH}$                                                                                     | —   | —    | 20   | $\mu\text{A}$ |
|                              | Clear    |                                                                                              | —   | —    | 60   |               |
|                              | Clock    |                                                                                              | —   | —    | 80   |               |
|                              | J, K     | $I_{IL}$                                                                                     | —   | —    | -0.4 | mA            |
|                              | Clear    |                                                                                              | —   | —    | 0.8  |               |
|                              | Clock    |                                                                                              | —   | —    | -0.8 |               |
|                              | J, K     | $I_I$                                                                                        | —   | —    | 0.1  | mA            |
|                              | Clear    |                                                                                              | —   | —    | 0.3  |               |
|                              | Clock    |                                                                                              | —   | —    | 0.4  |               |
| 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    | 6    | 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.

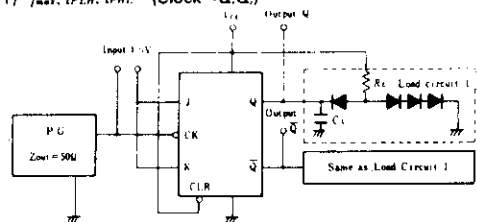
## SWITCHING CHARACTERISTICS ( $V_{CC}=5\text{V}$ , $T_a=25^\circ\text{C}$ )

| Item                    | Symbol    | Inputs | Outputs      | Test Conditions                           | min | typ | max | Unit |
|-------------------------|-----------|--------|--------------|-------------------------------------------|-----|-----|-----|------|
| Maximum clock frequency | $f_{max}$ |        |              |                                           | 30  | 45  | —   | MHz  |
| Propagation delay time  | $t_{PLH}$ | Clear  | Q, $\bar{Q}$ | $C_L=15\text{pF}$ , $R_L=2\text{k}\Omega$ | —   | 15  | 20  | ns   |
|                         | $t_{PHL}$ | Clock  |              |                                           | —   | 15  | 20  |      |

## TESTING METHOD

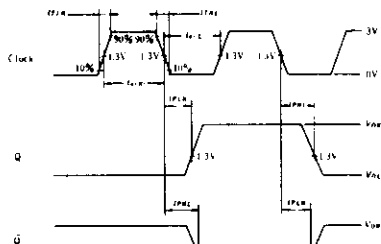
### 1) Test Circuit

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



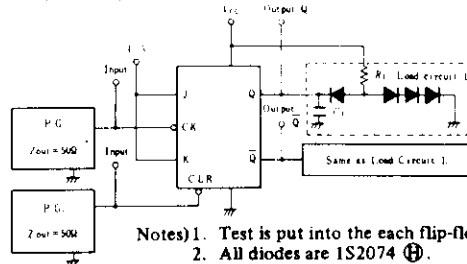
- Notes) 1. Test is put into the each flip flop  
2. All diodes are 1S2074  $\oplus$ .  
3.  $C_L$  includes probe and jig capacitance.

### Waveform



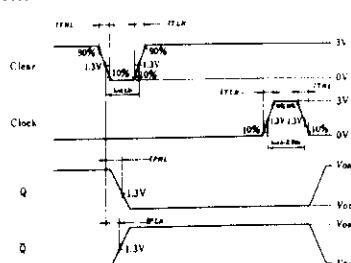
Note) Clock input pulse;  $t_{TLH} \leq 15\text{ns}$ ,  
 $t_{THL} \leq 6\text{ns}$ ,  $PRR=1\text{MHz}$ , duty  
cycle=50% and; for  $f_{max}$ ,  
 $t_{TLH}=t_{THL} \leq 2.5\text{ns}$ .

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

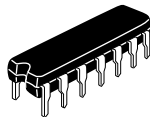


- Notes) 1. Test is put into the each flip-flop  
2. All diodes are 1S2074  $\oplus$ .  
3.  $C_L$  includes probe and jig capacitance.

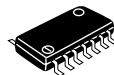
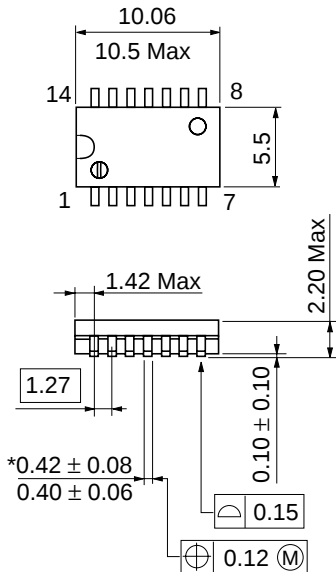
### Waveform



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

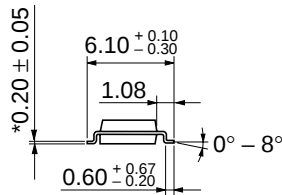
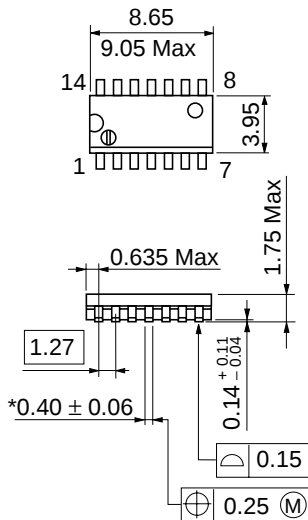


|                          |          |
|--------------------------|----------|
| Hitachi Code             | DP-14    |
| JEDEC                    | Conforms |
| EIAJ                     | Conforms |
| Weight (reference value) | 0.97 g   |



|                          |          |
|--------------------------|----------|
| Hitachi Code             | FP-14DA  |
| JEDEC                    | —        |
| EIAJ                     | Conforms |
| Weight (reference value) | 0.23 g   |

\*Dimension including the plating thickness  
Base material dimension



|                          |          |
|--------------------------|----------|
| Hitachi Code             | FP-14DN  |
| JEDEC                    | Conforms |
| EIAJ                     | Conforms |
| Weight (reference value) | 0.13 g   |

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