

HD74HC73

Dual J-K Flip-Flops (with Clear)

REJ03D0548-0200
 (Previous ADE-205-420)
 Rev.2.00
 Oct 06, 2005

Description

The flip-flop is edge sensitive to the clock input and change state on the negative going transition of the clock pulse. Each flip-flop has independent, J, K, clock, and clear inputs and Q and Q outputs. Clear is independent of the clock and accomplished by a low level on the input.






Features

- High Speed Operation: t_{pd} (Clock to Q) = 18 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 μ A max
- Low Quiescent Supply Current: I_{CC} (static) = 2 μ A max ($T_a = 25^\circ\text{C}$)
- Ordering Information

| Part Name | Package Type | Package Code (Previous Code) | Package Abbreviation | Taping Abbreviation (Quantity) |
|--------------|--------------------|------------------------------|----------------------|--------------------------------|
| HD74HC73P | DILP-14 pin | PRDP0014AB-B (DP-14AV) | P | — |
| HD74HC73FPEL | SOP-14 pin (JEITA) | PRSP0014DF-B (FP-14DAV) | FP | EL (2,000 pcs/reel) |
| HD74HC73RPEL | SOP-14 pin (JEDEC) | PRSP0014DE-A (FP-14DNV) | RP | EL (2,500 pcs/reel) |

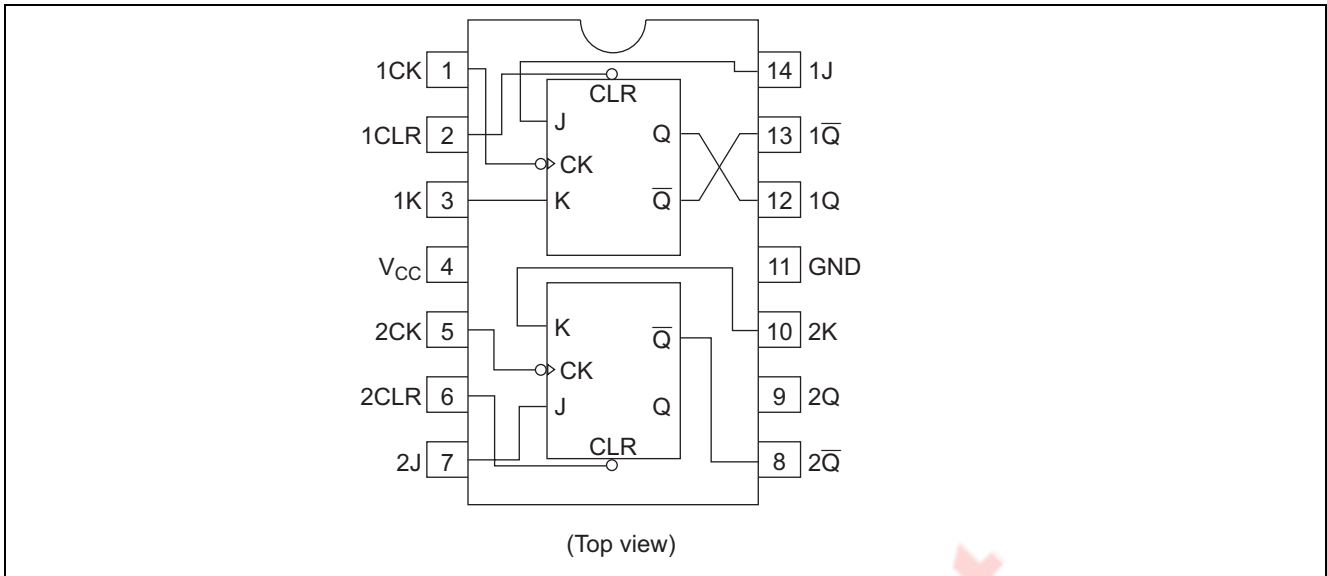
Note: Please consult the sales office for the above package availability.

Function Table

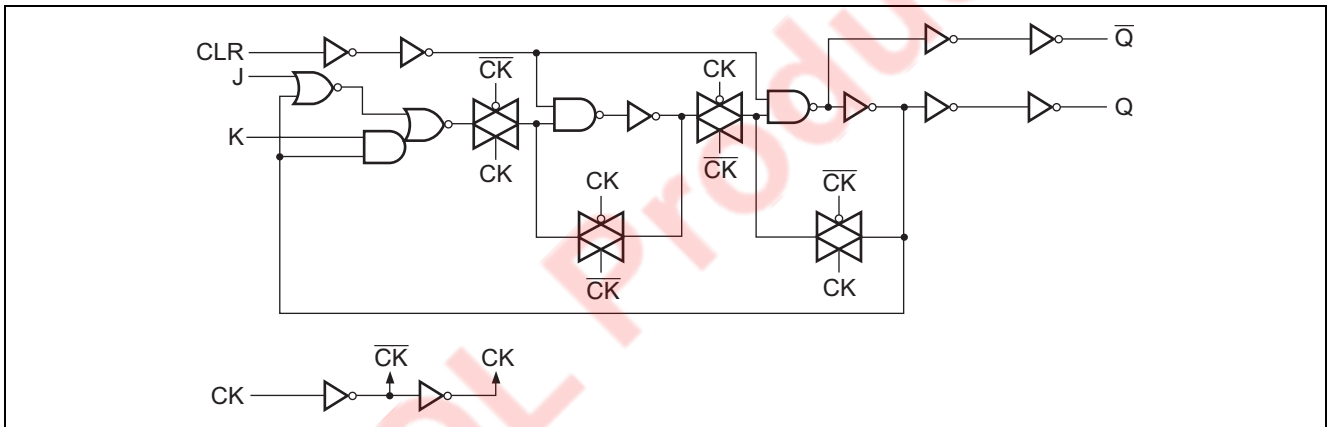
| Inputs | | | | Outputs | |
|--------|---|---|---|-----------|-----------|
| Clear | Clock | J | K | Q | \bar{Q} |
| L | X | X | X | L | H |
| H |  | L | L | No change | |
| H |  | L | H | L | H |
| H |  | H | L | H | L |
| L |  | H | H | Toggle | |
| H | L | X | X | No change | |
| H | H | X | X | No change | |
| H |  | X | X | No change | |

H : High level
 L : Low level
 X : Irrelevant

Pin Arrangement



Logic Diagram (1/2)



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 _O | ±25 | mA |
| V _{CC} , GND current | I _{CC} or I _{GND} | ±50 | mA |
| Power dissipation | P _T | 500 | mW |
| Storage temperature | T _{stg} | -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 | T_a | -40 to 85 | °C | |
| Input rise / fall time ^{*1} | t_r, t_f | 0 to 1000 | ns | $V_{CC} = 2.0\text{ V}$ |
| | | 0 to 500 | | $V_{CC} = 4.5\text{ V}$ |
| | | 0 to 400 | | $V_{CC} = 6.0\text{ V}$ |

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

Electrical Characteristics

| Item | Symbol | V_{CC} (V) | $T_a = 25^\circ\text{C}$ | | | $T_a = -40\text{ to }+85^\circ\text{C}$ | | 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 | $V_{in} = V_{IH}\text{ or }V_{IL}$ | $I_{OH} = -20\ \mu\text{A}$ |
| | | 4.5 | 4.4 | 4.5 | — | 4.4 | — | | | $I_{OH} = -4\ \text{mA}$ |
| | | 6.0 | 5.9 | 6.0 | — | 5.9 | — | | | $I_{OH} = -5.2\ \text{mA}$ |
| | | 4.5 | 4.18 | — | — | 4.13 | — | | | |
| | | 6.0 | 5.68 | — | — | 5.63 | — | | | |
| | V_{OL} | 2.0 | — | 0.0 | 0.1 | — | 0.1 | V | $V_{in} = V_{IH}\text{ or }V_{IL}$ | $I_{OL} = 20\ \mu\text{A}$ |
| | | 4.5 | — | 0.0 | 0.1 | — | 0.1 | | | |
| | | 6.0 | — | 0.0 | 0.1 | — | 0.1 | | | |
| | | 4.5 | — | — | 0.26 | — | 0.33 | | | $I_{OL} = 4\ \text{mA}$ |
| | | 6.0 | — | — | 0.26 | — | 0.33 | | | $I_{OL} = 5.2\ \text{mA}$ |
| Input current | I_{in} | 6.0 | — | — | ± 0.1 | — | ± 1.0 | μA | $V_{in} = V_{CC}\text{ or GND}$ | |
| Quiescent supply current | I_{CC} | 6.0 | — | — | 2.0 | — | 20 | μA | $V_{in} = V_{CC}\text{ or GND}, I_{out} = 0\ \mu\text{A}$ | |

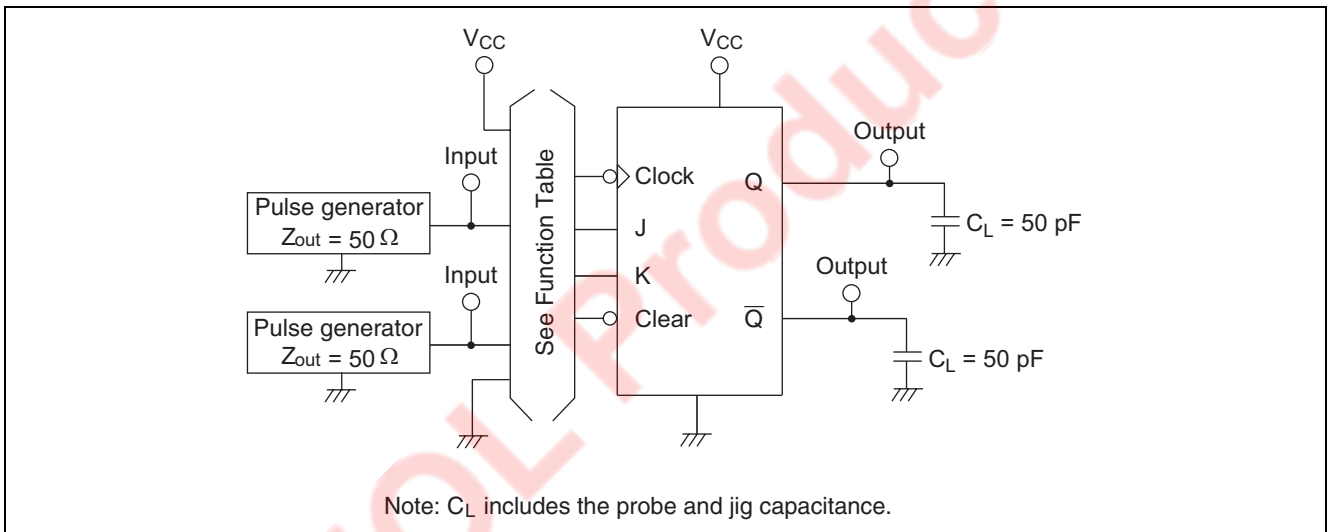
Switching Characteristics ($C_L = 50\ \text{pF}$, Input $t_r = t_f = 6\ \text{ns}$)

| Item | Symbol | V_{CC} (V) | $T_a = 25^\circ\text{C}$ | | | $T_a = -40\text{ to }+85^\circ\text{C}$ | | Unit | Test Conditions | | |
|-------------------------|--------------------|--------------|--------------------------|-----|-----|---|-----|------|-------------------------|-------------------------|--|
| | | | Min | Typ | Max | Min | Max | | | | |
| Maximum clock frequency | f_{max} | 2.0 | — | — | 6 | — | 5 | MHz | | | |
| | | 4.5 | — | — | 30 | — | 24 | | | | |
| | | 6.0 | — | — | 35 | — | 28 | | | | |
| Propagation delay time | t_{PLH}, t_{PHL} | 2.0 | — | — | 150 | — | 190 | ns | Clock to Q or \bar{Q} | | |
| | | 4.5 | — | 18 | 30 | — | 38 | | | | |
| | | 6.0 | — | — | 26 | — | 33 | | | | |
| | | | 2.0 | — | — | 140 | — | 175 | ns | Clear to Q or \bar{Q} | |
| | | | 4.5 | — | 18 | 28 | — | 35 | | | |
| | | | 6.0 | — | — | 24 | — | 30 | | | |
| Pulse width | t_w | 2.0 | 80 | — | — | 100 | — | ns | Clock, Clear | | |
| | | 4.5 | 16 | 8 | — | 20 | — | | | | |
| | | 6.0 | 14 | — | — | 17 | — | | | | |

Switching Characteristics ($C_L = 50 \text{ pF}$, Input $t_r = t_f = 6 \text{ ns}$)

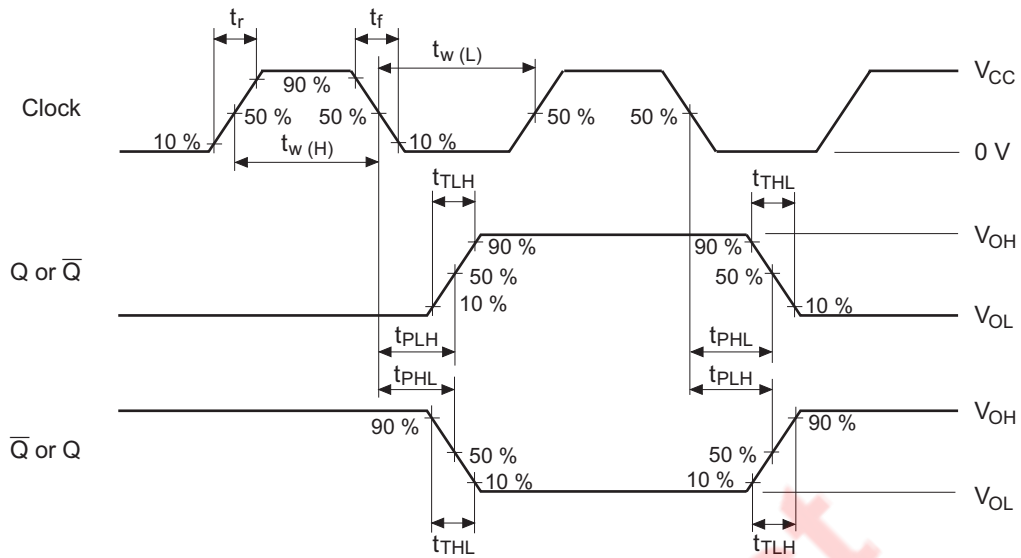
| Item | Symbol | V_{CC} (V) | $T_a = 25^\circ\text{C}$ | | | $T_a = -40 \text{ to } +85^\circ\text{C}$ | | Unit | Test Conditions |
|-----------------------|--------------------|--------------|--------------------------|-----|-----|---|-----|------|-----------------|
| | | | Min | Typ | Max | Min | Max | | |
| Setup time | t_{su} | 2.0 | 100 | — | — | 125 | — | ns | Data to clock |
| | | 4.5 | 20 | 3 | — | 25 | — | | |
| | | 6.0 | 17 | — | — | 21 | — | | |
| Hold time | t_h | 2.0 | 5 | — | — | 5 | — | ns | Clock to data |
| | | 4.5 | 5 | -2 | — | 5 | — | | |
| | | 6.0 | 5 | — | — | 5 | — | | |
| Removal time | t_{rem} | 2.0 | 100 | — | — | 125 | — | ns | Clear to clock |
| | | 4.5 | 20 | -3 | — | 25 | — | | |
| | | 6.0 | 17 | — | — | 21 | — | | |
| Output rise/fall time | t_{TLH}, t_{THL} | 2.0 | — | — | 75 | — | 95 | ns | |
| | | 4.5 | — | 5 | 15 | — | 19 | | |
| | | 6.0 | — | — | 13 | — | 16 | | |
| Input capacitance | C_{in} | — | — | 5 | 10 | — | 10 | pF | |

Test Circuit

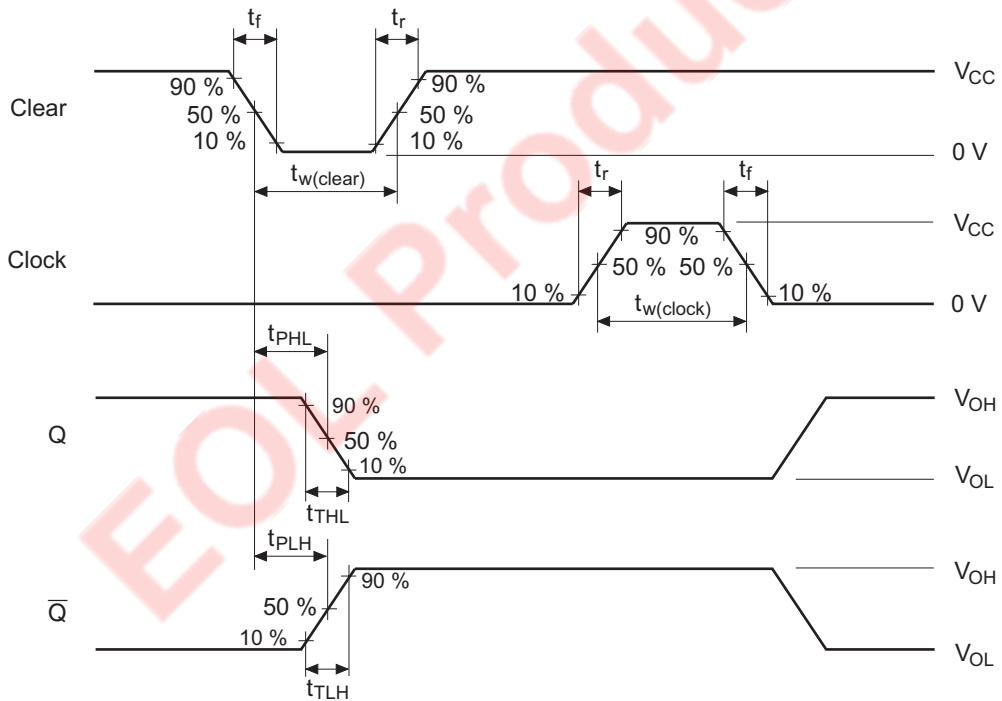


Waveforms

• Waveform – 1

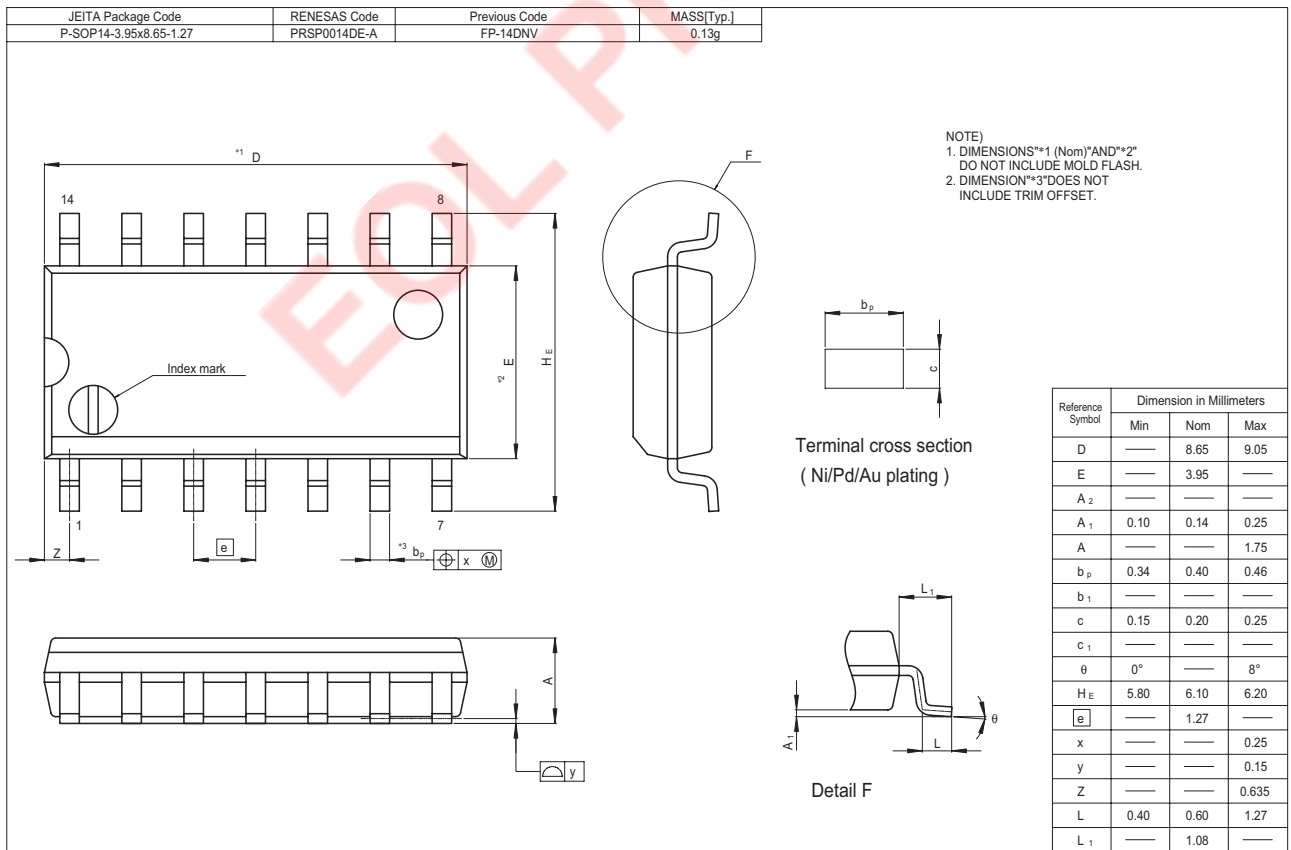
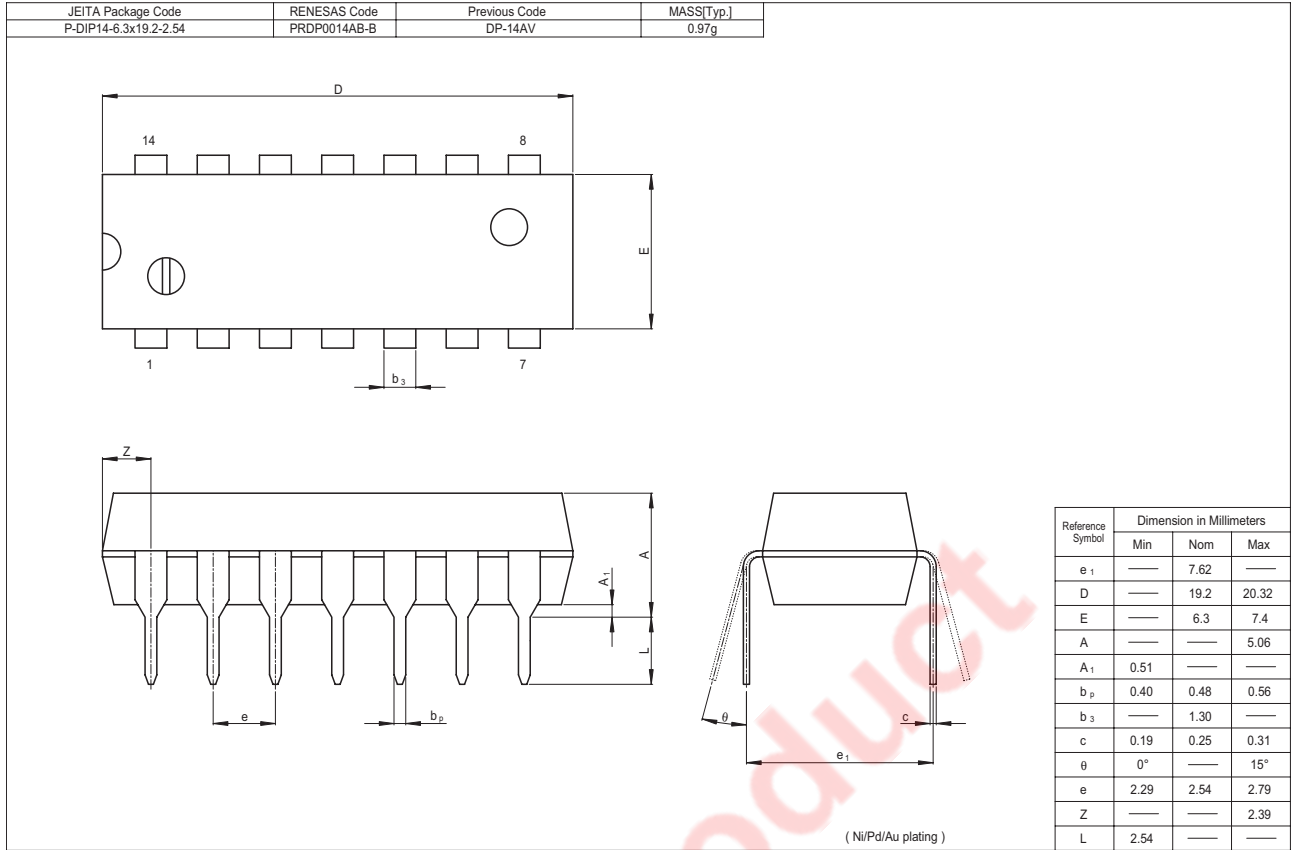


• Waveform – 2



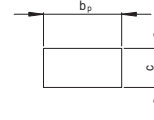
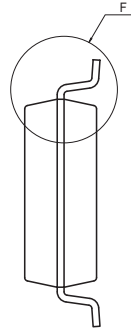
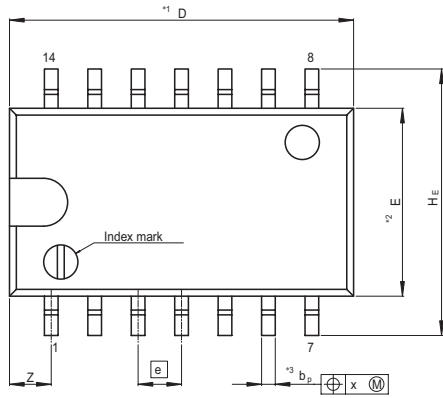
- Notes: 1. Input waveform: $PRR \leq 1 \text{ MHz}$, $Z_o = 50 \Omega$, $t_r \leq 6 \text{ ns}$, $t_f \leq 6 \text{ ns}$
 2. The output are measured one at a time with one transition per measurement.

Package Dimensions

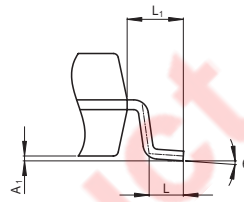


HD74HC73

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