

HD74HC74

Dual D-type Flip-Flops (with Preset and Clear)

REJ03D0549-0200
 (Previous ADE-205-421)
 Rev.2.00
 Oct 06, 2005

Description

The flip-flop has independent data, preset, clear, and clock inputs and Q and \bar{Q} outputs. The logic level present at the data input is transferred to the output during the positive going transition to the clock pulse. Preset and clear are independent of the clock and accomplished by a low level at the appropriate input.

Features

- High Speed Operation: t_{pd} (Clock to Q or \bar{Q}) = 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 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) |
|--------------|--------------------|------------------------------|----------------------|--------------------------------|
| HD74HC74P | DILP-14 pin | PRDP0014AB-B (DP-14AV) | P | — |
| HD74HC74FPEL | SOP-14 pin (JEITA) | PRSP0014DF-B (FP-14DAV) | FP | EL (2,000 pcs/reel) |
| HD74HC74TELL | TSSOP-14 pin | PTSP0014JA-B (TTP-14DV) | T | ELL (2,000 pcs/reel) |

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

Function Table

| Inputs | | | | Outputs | |
|--------|-------|--------------|------|-----------|-----------|
| Preset | Clear | Clock | Data | Q | \bar{Q} |
| L | H | X | X | H | L |
| H | L | X | X | L | H |
| L | L | X | X | H^* | H^* |
| H | H | \uparrow | H | H | L |
| H | H | \uparrow | L | L | H |
| H | H | L | X | No change | |
| H | H | H | X | No change | |
| H | H | \downarrow | X | No change | |

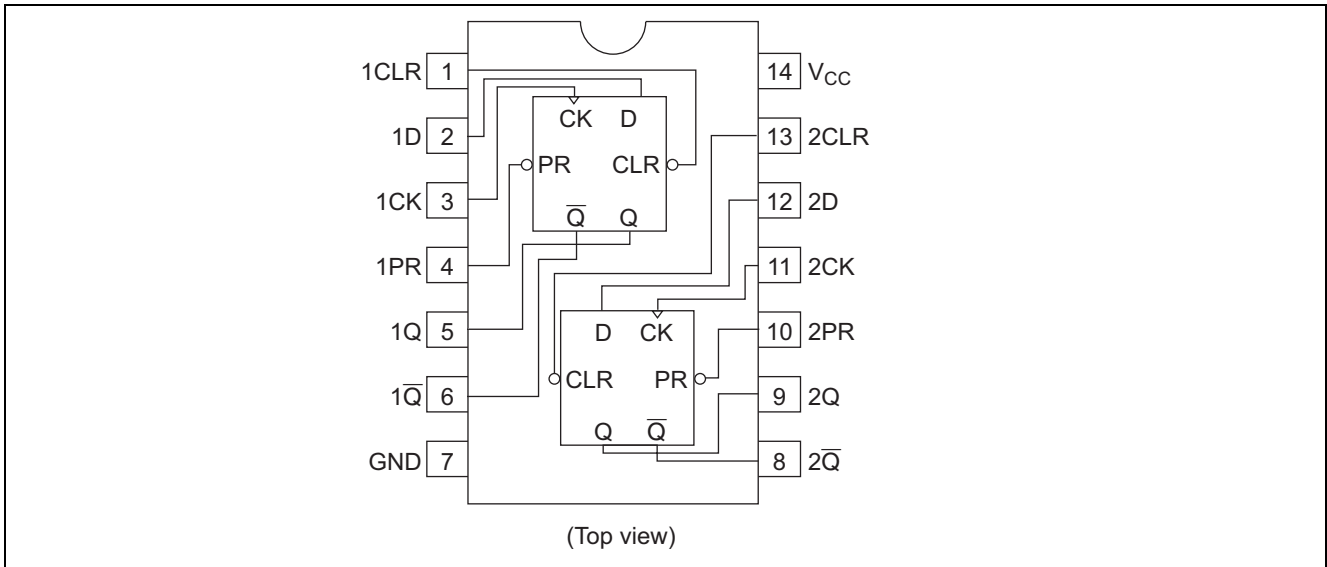
H : High level

L : Low level

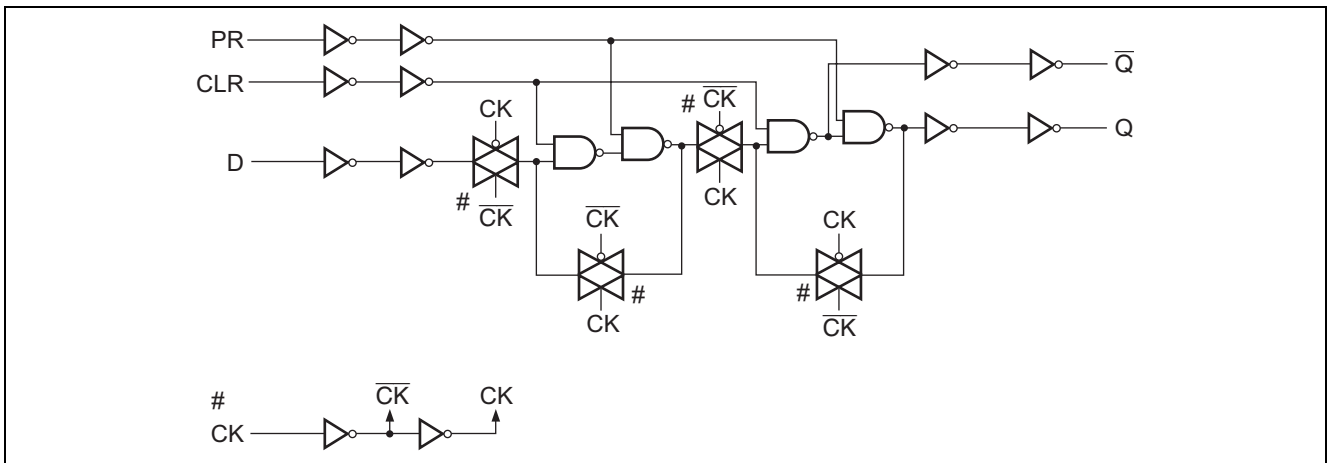
X : Irrelevant

Note: 1. Q and \bar{Q} will remain High as long as Preset and Clear are Low, but Q and \bar{Q} are unpredictable, if Preset and Clear go High simultaneously.

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 | $^{\circ}C$ |

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 | — | | | |
| | | 6.0 | — | — | — | — | — | | | |
| | 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 | $V_{in} = V_{CC}\text{ or GND}, I_{out} = 0\ \mu\text{A}$ | |

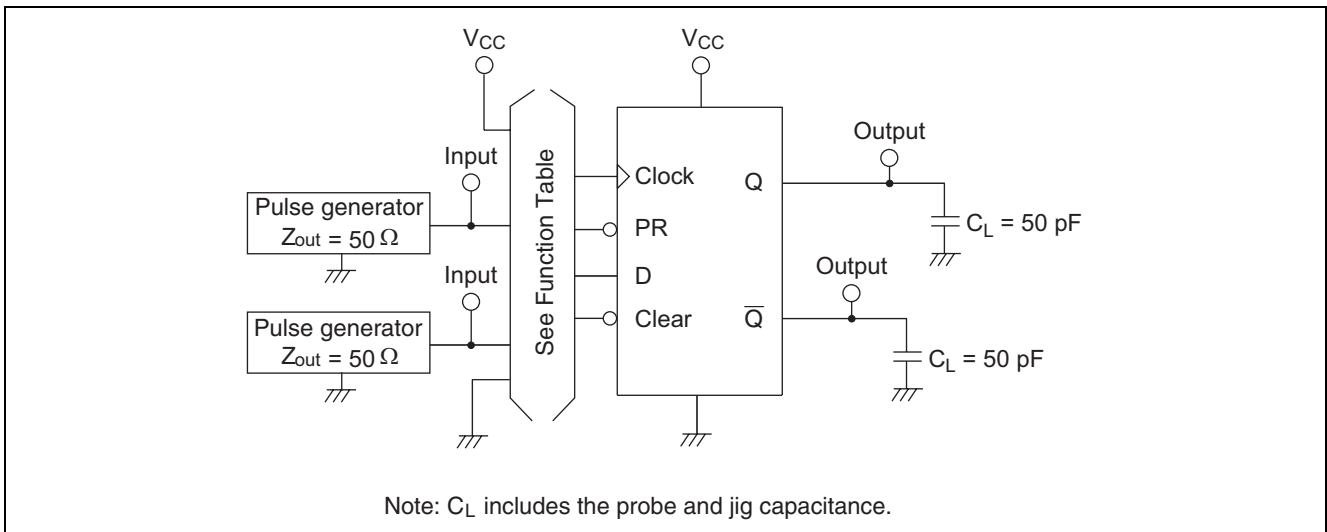
Switching Characteristics ($C_L = 50\ \text{pF}$, Input $t_r = t_f = 6\ \text{ns}$)

| 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 | — | — | 5 | — | 4 | MHz | | | |
| | | 4.5 | — | — | 35 | 25 | — | | | | 20 |
| | | 6.0 | — | — | — | 29 | — | | | | 24 |
| Propagation delay time | t_{PLH}, t_{PHL} | 2.0 | — | — | 160 | — | 200 | ns | Clock to Q or \bar{Q} | | |
| | | 4.5 | — | — | 14 | 32 | — | | | 40 | |
| | | 6.0 | — | — | — | 27 | — | | | 34 | |
| | | 2.0 | — | — | 160 | — | 200 | ns | | Preset or Clear to Q or \bar{Q} | |
| | | 4.5 | — | — | 13 | 32 | — | | | | 40 |
| | | 6.0 | — | — | — | 27 | — | | | | 34 |
| Setup time | t_{su} | 2.0 | 100 | — | — | 125 | — | ns | Data to Clock | | |
| | | 4.5 | 20 | 1 | — | 25 | — | | | | |
| | | 6.0 | 17 | — | — | 21 | — | | | | |

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

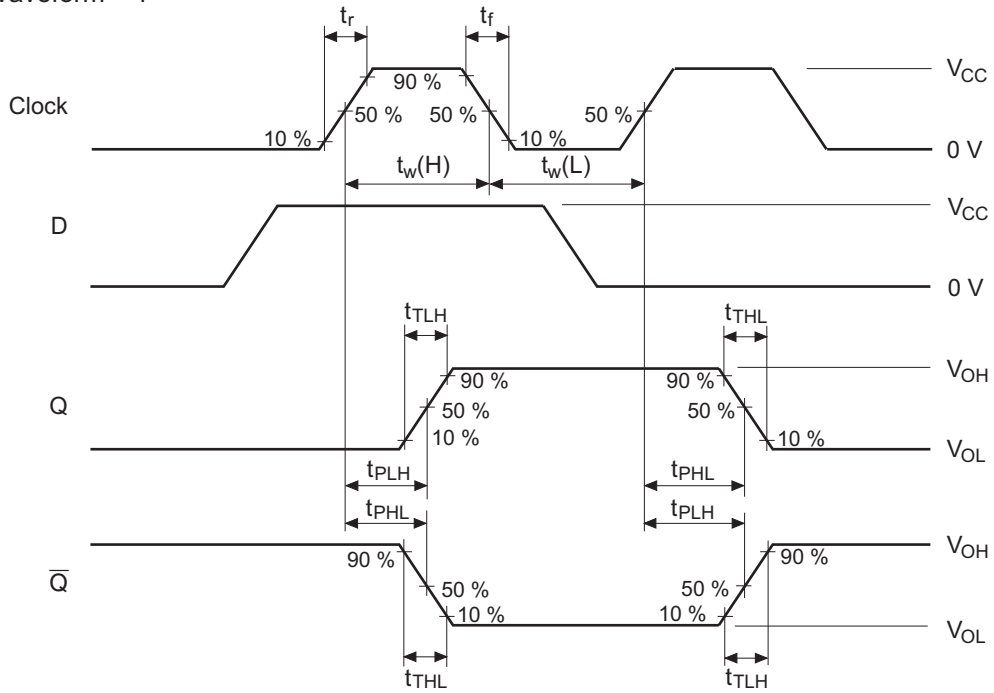
| Item | Symbol | V_{CC} (V) | $T_a = 25^\circ\text{C}$ | | | $T_a = -40 \text{ to } +85^\circ\text{C}$ | | Unit | Test Conditions |
|-----------------------|--------------------|--------------|--------------------------|-----|-----|---|-----|------|------------------------|
| | | | Min | Typ | Max | Min | Max | | |
| Hold time | t_h | 2.0 | 5 | — | — | 5 | — | ns | Clock to Data |
| | | 4.5 | 5 | 0 | — | 5 | — | | |
| | | 6.0 | 5 | -5 | — | 5 | — | | |
| Removal time | t_{rem} | 2.0 | 25 | — | — | 31 | — | ns | Preset, Clear to Clock |
| | | 4.5 | 5 | — | — | 6 | — | | |
| | | 6.0 | 4 | — | — | 5 | — | | |
| Pulse width | t_w | 2.0 | 80 | — | — | 100 | — | ns | Clock, Preset, Clear |
| | | 4.5 | 16 | 8 | — | 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 | C_{in} | — | — | 5 | 10 | — | 10 | pF | |

Test Circuit

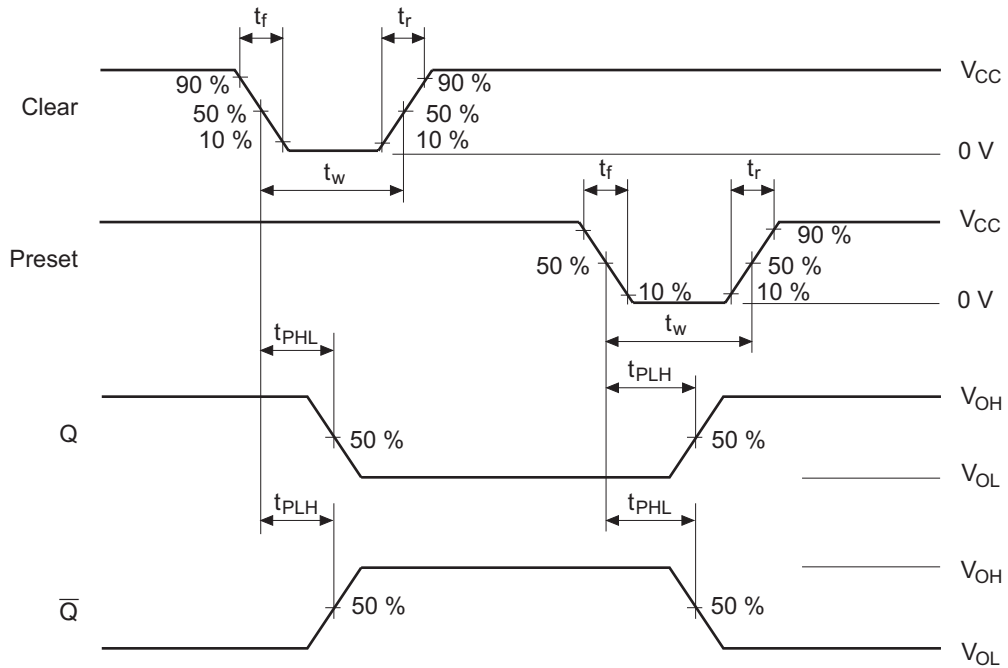


Waveforms

• Waveform – 1

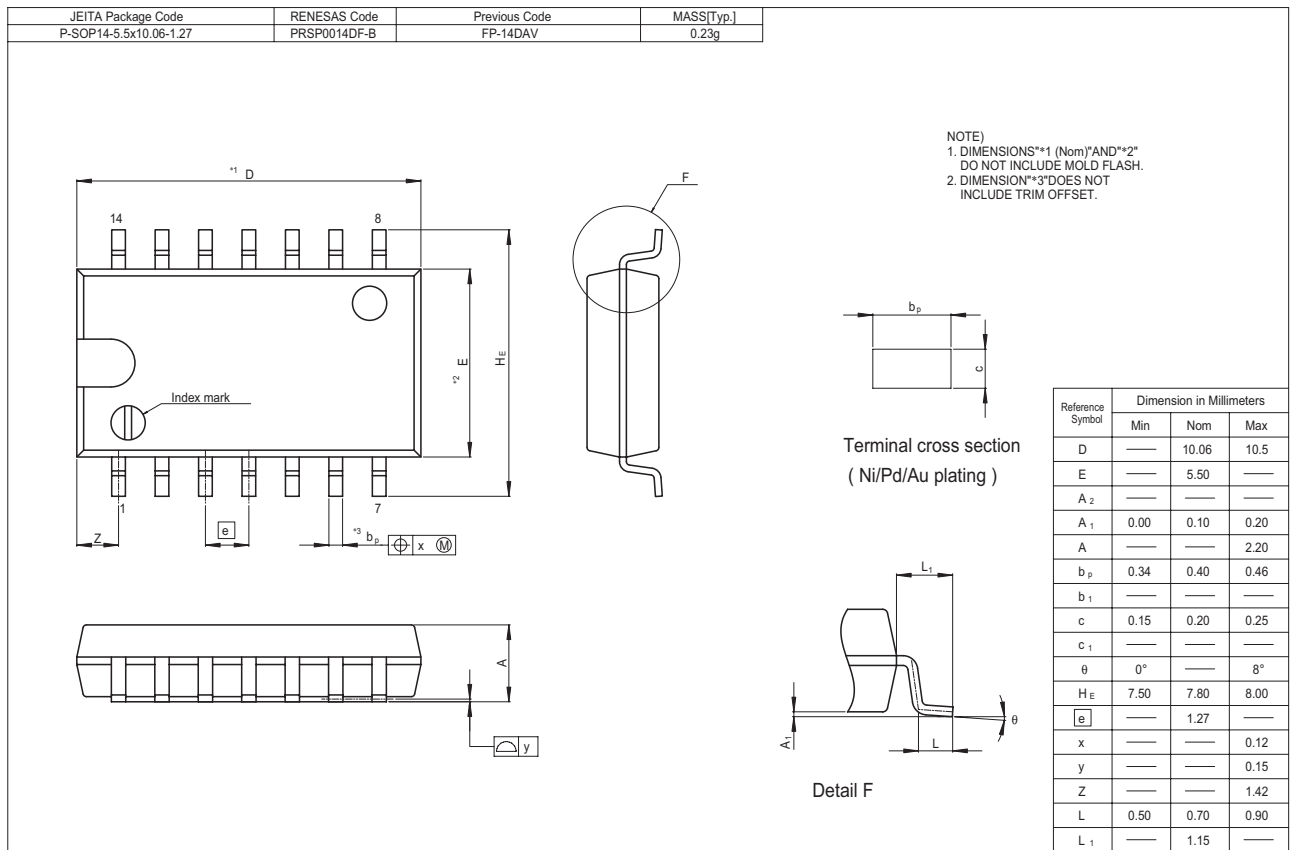
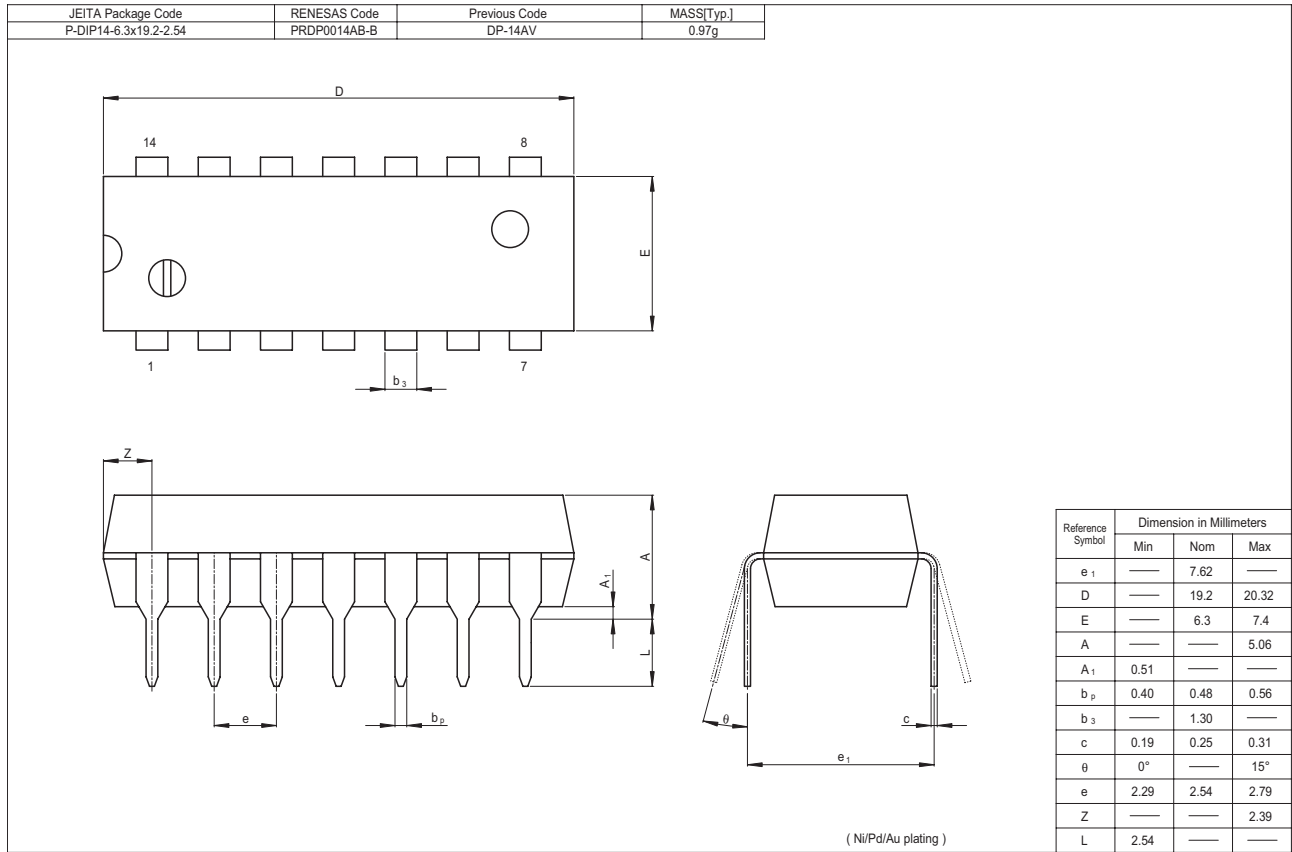


• Waveform – 2

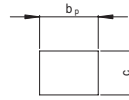
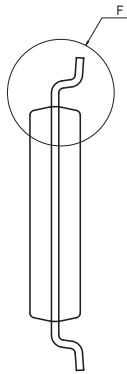
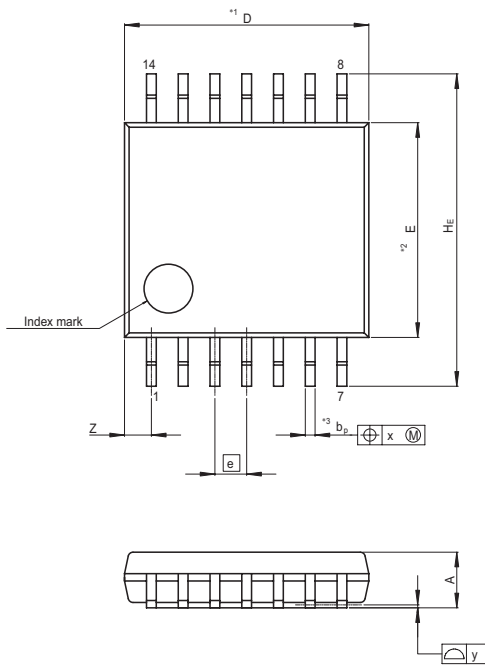


Notes: 1. Input waveform: $PRR \leq 1 \text{ MHz}$, $Z_o = 50 \Omega$, $t_r \leq 6 \text{ ns}$, $t_f \leq 6 \text{ ns}$
 2. The output are measured one at a time with one transition per measurement.

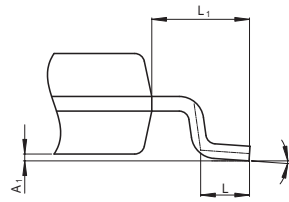
Package Dimensions



| | | | |
|--|------------------------------|---------------------------|---------------------|
| JEITA Package Code P-TSSOP14-4.4x5-0.65 | RENESAS Code PTSP0014JA-B | Previous Code TTP-14DV | MASS[Typ.] 0.05g |
|--|------------------------------|---------------------------|---------------------|



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 | — | 5.00 | 5.30 |
| E | — | 4.40 | — |
| A ₂ | — | — | — |
| A ₁ | 0.03 | 0.07 | 0.10 |
| A | — | — | 1.10 |
| b _p | 0.15 | 0.20 | 0.25 |
| b ₁ | — | — | — |
| c | 0.10 | 0.15 | 0.20 |
| c ₁ | — | — | — |
| θ | 0° | — | 8° |
| H _E | 6.20 | 6.40 | 6.60 |
| e | — | 0.65 | — |
| x | — | — | 0.13 |
| y | — | — | 0.10 |
| Z | — | — | 0.83 |
| L | 0.4 | 0.5 | 0.6 |
| L ₁ | — | 1.0 | — |

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