

1. General Description

The EM74HC74 and EM74HCT74 are dual positive edge triggered D-type flip-flop. They have individual data (nD), clock (nCP), set ($n\bar{S}D$) and reset ($n\bar{R}D$) inputs, and complementary nQ and $n\bar{Q}$ outputs. Data at the nD -input, that meets the set-up and hold time requirements on the LOW-to-HIGH clock transition, is stored in the flip-flop and appears at the nQ output. Schmitt-trigger action in the clock input, makes the circuit highly tolerant to slower clock rise and fall times. Inputs include clamp diodes that enable the use of current limiting resistors to interface inputs to voltages in excess of V_{CC} .

2. Features and Benefits

- Wide operating voltage 2.0 V to 6.0 V
- High noise immunity
- CMOS low power dissipation
- Input levels:
 - For EM74HC74: CMOS level
 - For EM74HCT74: TTL level
- Symmetrical output impedance
- Balanced propagation delays
- Latch-up performance exceeds 250 mA
- Complies with JEDEC standard:
 - JESD8C (2.7 V to 3.6 V)
 - JESD7A (2.0 V to 6.0 V)
- ESD protection:
 - HBM ANSI/ESDA/JEDEC JS-001 Class 3A exceeds 3500 V
 - CDM ANSI/ESDA/JEDEC JS-002 Class C3 exceeds 2000 V
- Multiple package options

EM74HC74; EM74HCT74

Dual D-type flip-flop with set and reset; positive edge-trigger

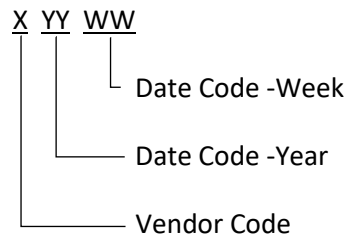
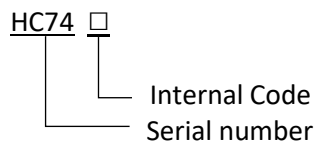
3. Ordering Information

Table 1. Ordering information

| Type number | Topside marking | Package | | |
|-------------|-----------------|-----------|---|----------|
| | | Name | Description | Quantity |
| EM74HC74D | HC74□ XYYWW | SOP-14L | plastic small outline package; 14 leads; body width 3.9 mm | 3000 |
| EM74HCT74D | HCT74□ XYYWW | | | |
| EM74HC74PW | HC74□ XYYWW | TSSOP-14L | plastic thin shrink small outline package; 14 leads; body width 4.4 mm | 3000 |
| EM74HCT74PW | HCT74□ XYYWW | | | |

MARKING INFORMATION

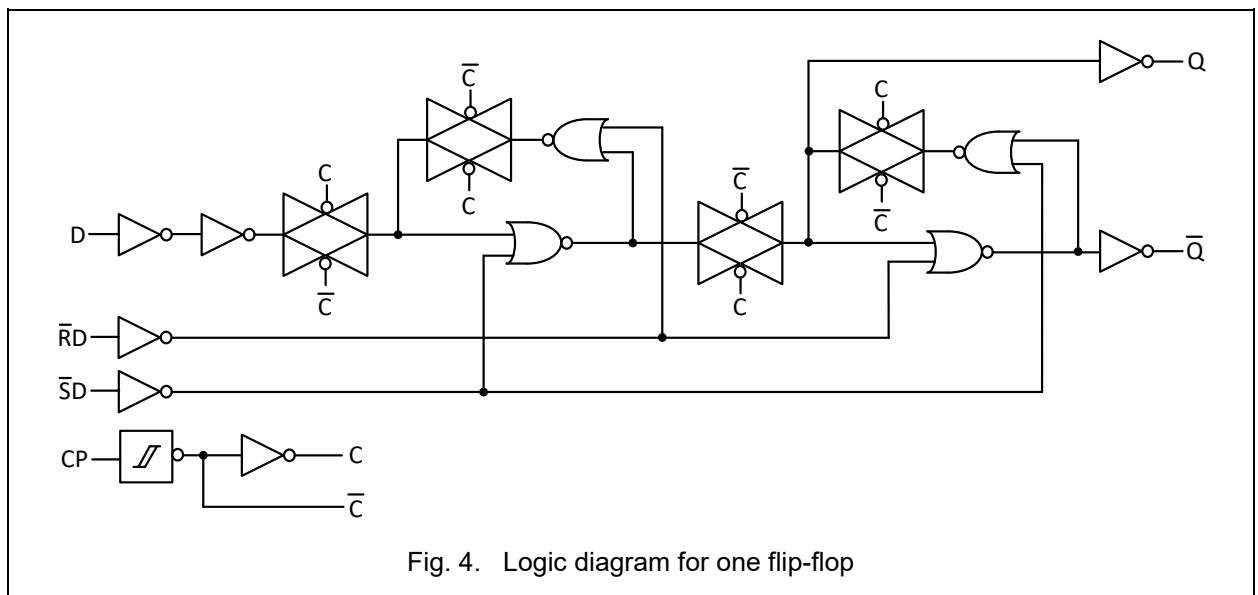
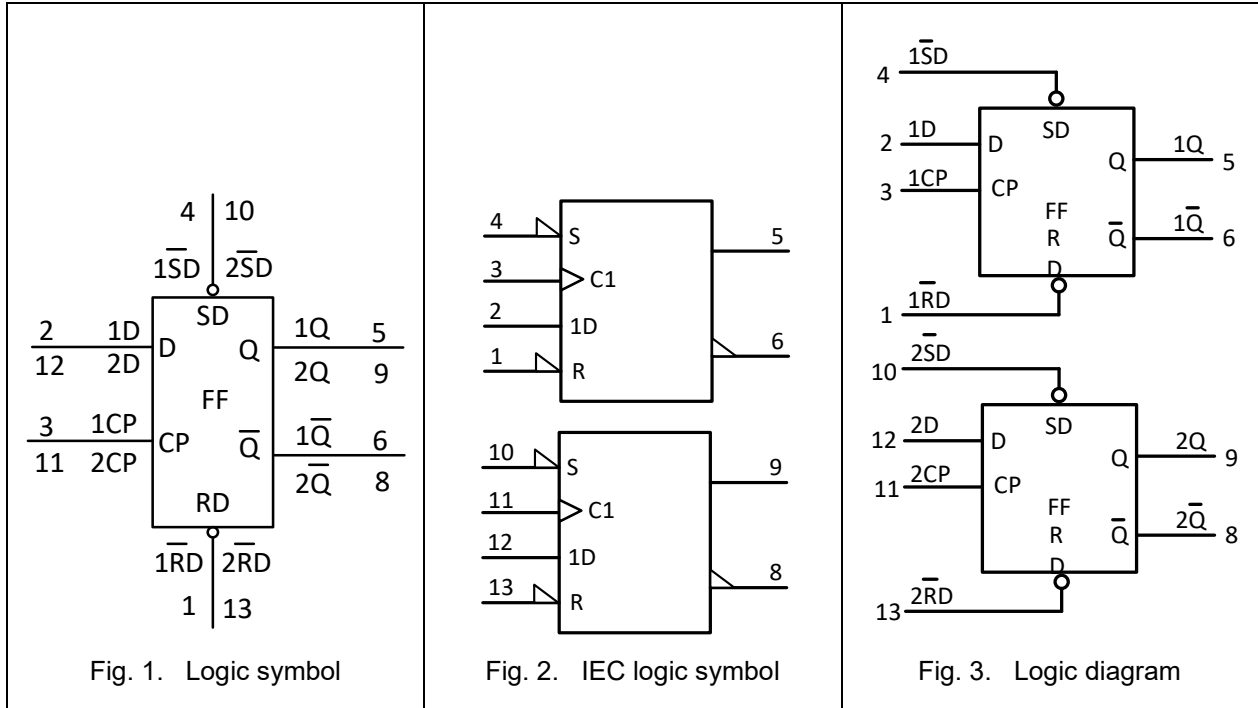
NOTE: HC74□ = Serial number and Internal code; XYYWW = Vendor Code and Date Code.



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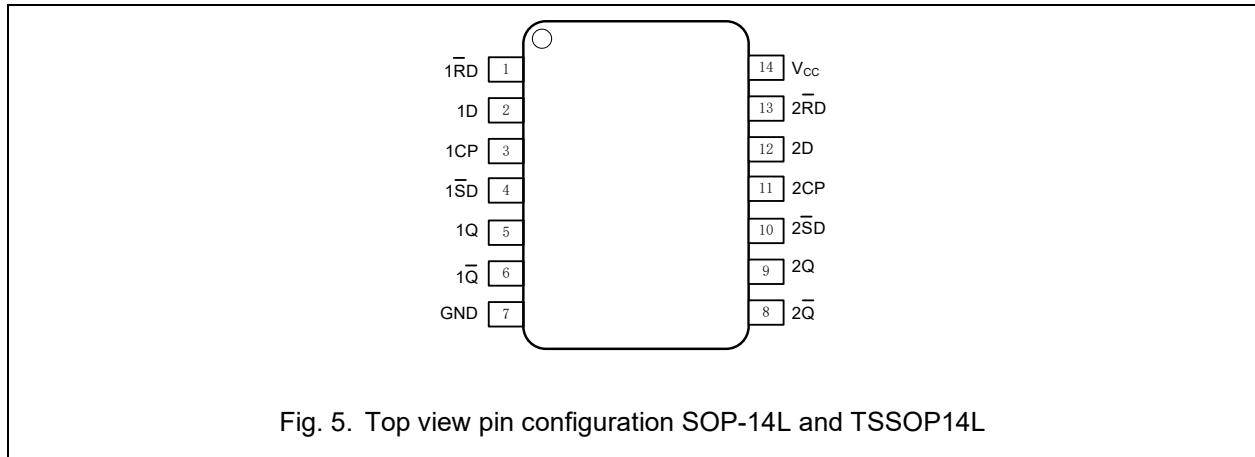
Dual D-type flip-flop with set and reset; positive edge-trigger

4. Function Diagram



5. Pinning Information

5.1. Pinning



5.2. Pin description

Table 2. Pin description

| Symbol | Pin | Description |
|-----------------|-------|--|
| 1R̄D, 2R̄D | 1, 13 | asynchronous reset-direct input (active LOW) |
| 1D, 2D | 2, 12 | data output |
| 1CP, 2CP | 3,11 | clock input (LOW-to-HIGH, edge-triggered) |
| 1S̄D, 2S̄D | 4,10 | asynchronous set-direct input (active LOW) |
| 1Q, 2Q | 5,9 | output |
| 1Q̄, 2Q̄ | 6,8 | complement output |
| GND | 7 | ground (0 V) |
| V _{CC} | 14 | supply voltage |

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Dual D-type flip-flop with set and reset; positive edge-trigger

6. Functional Description

Table 3. Function table

H = HIGH voltage level; L = LOW voltage level; X = don't care.

| Input | | | | Output | |
|------------------|------------------|-----|----|--------|-----------------|
| \overline{nSD} | \overline{nRD} | nCP | nD | nQ | \overline{nQ} |
| L | H | X | X | H | L |
| H | L | X | X | L | H |
| L | L | X | X | H | H |

Table 4. Function table

H = HIGH voltage level; L = LOW voltage level; X = don't care;

↑ = LOW-to-HIGH transition; Q_{n+1} = state after the next LOW-to-HIGH CP transition.

| Input | | | | Output | |
|------------------|------------------|-----|----|------------|-----------------------|
| \overline{nSD} | \overline{nRD} | nCP | nD | nQ_{n+1} | \overline{nQ}_{n+1} |
| H | H | ↑ | L | L | H |
| H | H | ↑ | H | H | L |

7. Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Table 5. Absolute Maximum Ratings

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND.

| Symbol | Parameter | Conditions | Min | Max | Unit |
|-----------|-------------------------|--|------|------|------|
| V_{CC} | supply voltage | | -0.5 | 7 | V |
| I_{IK} | input clamping current | $V_I < -0.5\text{ V}$ or $V_I > V_{CC} + 0.5\text{ V}$ | | ±20 | mA |
| I_{OK} | output clamping current | $V_O < -0.5\text{ V}$ or $V_O > V_{CC} + 0.5\text{ V}$ | | ±20 | mA |
| I_O | output current | $-0.5\text{ V} < V_O < V_{CC} + 0.5\text{ V}$ | | ±25 | mA |
| I_{CC} | supply current | | | 100 | mA |
| I_{GND} | ground current | | -100 | | mA |
| P_{tot} | total power dissipation | $T_{amb} = -40\text{ °C}$ to $+125\text{ °C}$ | | 500 | mW |
| T_{stg} | storage temperature | | -65 | +150 | °C |

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8. Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. EnergyMath does not recommend exceeding them or designing to Absolute Maximum Ratings.

Table 6. Recommended Operating Conditions

| Symbol | Parameter | Conditions | EM74HC74 | | | EM74HCT74 | | | Unit |
|------------------|-------------------------------------|-------------------------|----------|------|-----------------|-----------|------|-----------------|------|
| | | | Min | Typ | Max | Min | Typ | Max | |
| V _{CC} | supply voltage | | 2.0 | 5.0 | 6.0 | 4.5 | 5.0 | 5.5 | V |
| V _I | input voltage | | 0 | | V _{CC} | 0 | | V _{CC} | V |
| V _O | output voltage | | 0 | | V _{CC} | 0 | | V _{CC} | V |
| T _{amb} | ambient temperature | | -40 | +25 | +125 | -40 | +25 | +125 | °C |
| Δt/ΔV | input transition rise and fall rate | V _{CC} = 2.0 V | | | 625 | | | | ns/V |
| | | V _{CC} = 4.5 V | | 1.67 | 139 | | 1.67 | 139 | ns/V |
| | | V _{CC} = 6.0 V | | | 83 | | | | ns/V |

9. Static Characteristics

Table 7. Static characteristics

At recommended operating conditions. Voltages are referenced to GND (ground = 0 V).

| Symbol | Parameter | Conditions | -40 °C to +85 °C | | | -40 °C to +125 °C | | Unit |
|-----------------|---------------------------|---|------------------|--------|------|-------------------|------|------|
| | | | Min | Typ[1] | Max | Min | Max | |
| EM74HC74 | | | | | | | | |
| V _{IH} | HIGH-level input voltage | V _{CC} = 2.0 V | 1.5 | 1.2 | | 1.5 | | V |
| | | V _{CC} = 4.5 V | 3.15 | 2.5 | | 3.15 | | V |
| | | V _{CC} = 6.0 V | 4.2 | 3.3 | | 4.2 | | V |
| V _{IL} | LOW-level input voltage | V _{CC} = 2.0 V | | 0.8 | 0.5 | | 0.5 | V |
| | | V _{CC} = 4.5 V | | 2.1 | 1.35 | | 1.35 | V |
| | | V _{CC} = 6.0 V | | 2.8 | 1.8 | | 1.8 | V |
| V _{OH} | HIGH-level output voltage | V _I = V _{IH} or V _{IL} | | | | | | |
| | | I _O = -4.0 mA; V _{CC} = 4.5 V | 3.84 | 4.4 | | 3.7 | | V |
| | | I _O = -5.2 mA; V _{CC} = 6.0 V | 5.34 | 5.9 | | 5.2 | | V |

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Dual D-type flip-flop with set and reset; positive edge-trigger

| Symbol | Parameter | Conditions | -40 °C to +85 °C | | | -40 °C to +125 °C | | Unit |
|------------------|---------------------------|--|------------------|--------|------|-------------------|------|------|
| | | | Min | Typ[1] | Max | Min | Max | |
| V _{OL} | LOW-level output voltage | V _I = V _{IH} or V _{IL} | | | | | | |
| | | I _O = 4.0 mA; V _{CC} = 4.5 V | | 0.03 | 0.33 | | 0.4 | V |
| | | I _O = 5.2 mA; V _{CC} = 6.0 V | | 0.04 | 0.33 | | 0.4 | V |
| I _I | Input leakage current | V _I = V _{CC} or GND ; V _{CC} = 6.0 V | | 0.01 | ±1 | | ±1 | µA |
| I _{CC} | supply current | V _I = V _{CC} or GND ; I _O = 0A ; V _{CC} = 6.0 V | | 0.01 | 20 | | 40 | µA |
| C _I | input capacitance | | | 7 | | | | pF |
| EM74HCT74 | | | | | | | | |
| V _{IH} | HIGH-level input voltage | V _{CC} = 4.5 V to 5.5 V | 2.0 | 1.7 | | 2.0 | | V |
| V _{IL} | LOW-level input voltage | V _{CC} = 4.5 V to 5.5 V | | 1.3 | 0.8 | | 0.8 | V |
| V _{OH} | HIGH-level output voltage | V _I = V _{IH} or V _{IL} ; V _{CC} = 4.5 V | | | | | | |
| | | I _O = -4.0 mA | 3.84 | 4.4 | - | 3.7 | | V |
| V _{OL} | LOW-level output voltage | V _I = V _{IH} or V _{IL} ; V _{CC} = 4.5 V | | | | | | |
| | | I _O = 4.0 mA | | 0.03 | 0.33 | | 0.4 | V |
| I _I | Input leakage current | V _I = V _{CC} or GND ; V _{CC} = 5.5 V | | 0.01 | ±1 | | ±1 | µA |
| I _{CC} | supply current | V _I = V _{CC} or GND ; I _O = 0A ; V _{CC} = 5.5 V | | 0.01 | 20 | | 40 | µA |
| ΔI _{CC} | additional supply current | V _I = V _{CC} - 2.1 V; I _O = 0 A; other inputs at V _{CC} or GND; V _{CC} = 4.5 V to 5.5 V | | | | | | |
| | | per input pin; nD, nRD inputs | | 350 | 500 | | 550 | µA |
| | | per input pin; nSD inputs | | 640 | 850 | | 950 | µA |
| | | per input pin; nCP inputs | | 1130 | 1550 | | 1650 | µA |
| C _I | input capacitance | | | 7 | | | | pF |

[1] All typical values are measured at T_{amb} = 25°C.

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Dual D-type flip-flop with set and reset; positive edge-trigger

10. Dynamic Characteristics

Table 8. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 8.

| Symbol | Parameter | Conditions | -40 °C to +85 °C | | | -40 °C to +125 °C | | Unit |
|-----------------|-------------------|--|------------------|--------|-----|-------------------|-----|------|
| | | | Min | Typ[1] | Max | Min | Max | |
| EM74HC74 | | | | | | | | |
| t_{pd} | propagation delay | nCP to nQ, n \bar{Q} ; see Fig. 6 [2] | | | | | | |
| | | $V_{CC} = 2.0\text{ V}$ | | | 30 | | 33 | ns |
| | | $V_{CC} = 4.5\text{ V}$ | | | 16 | | 19 | ns |
| | | $V_{CC} = 6.0\text{ V}$ | | | 12 | | 14 | ns |
| | | n $\bar{S}D$ to nQ, n \bar{Q} ; see Fig. 7 [2] | | | | | | |
| | | $V_{CC} = 2.0\text{ V}$ | | | 30 | | 33 | ns |
| | | $V_{CC} = 4.5\text{ V}$ | | | 16 | | 19 | ns |
| | | $V_{CC} = 6.0\text{ V}$ | | | 12 | | 14 | ns |
| | | n $\bar{R}D$ to nQ, n \bar{Q} ; see Fig. 7 [2] | | | | | | |
| | | $V_{CC} = 2.0\text{ V}$ | | | 30 | | 33 | ns |
| | | $V_{CC} = 4.5\text{ V}$ | | | 16 | | 19 | ns |
| | | $V_{CC} = 6.0\text{ V}$ | | | 12 | | 14 | ns |
| t_t | transition time | nQ, n \bar{Q} ; see Fig. 6 [3] | | | | | | |
| | | $V_{CC} = 2.0\text{ V}$ | | | 9 | | 11 | ns |
| | | $V_{CC} = 4.5\text{ V}$ | | | 6 | | 8 | ns |
| | | $V_{CC} = 6.0\text{ V}$ | | | 4 | | 5 | ns |
| t_w | pulse width | nCP HIGH or LOW; see Fig. 6 | | | | | | |
| | | $V_{CC} = 2.0\text{ V}$ | 100 | | | 120 | | ns |
| | | $V_{CC} = 4.5\text{ V}$ | 20 | | | 24 | | ns |
| | | $V_{CC} = 6.0\text{ V}$ | 17 | | | 20 | | ns |
| | | n $\bar{S}D$, n $\bar{R}D$ LOW; see Fig. 7 | | | | | | |
| | | $V_{CC} = 2.0\text{ V}$ | 100 | | | 120 | | ns |
| | | $V_{CC} = 4.5\text{ V}$ | 20 | | | 24 | | ns |
| | | $V_{CC} = 6.0\text{ V}$ | 17 | | | 20 | | ns |
| t_{rec} | recovery time | n $\bar{S}D$, n $\bar{R}D$; see Fig. 7 | | | | | | |
| | | $V_{CC} = 2.0\text{ V}$ | 40 | | | 45 | | ns |
| | | $V_{CC} = 4.5\text{ V}$ | 8 | | | 9 | | ns |

EM74HC74; EM74HCT74

Dual D-type flip-flop with set and reset; positive edge-trigger

| Symbol | Parameter | Conditions | -40 °C to +85 °C | | | -40 °C to +125 °C | | Unit |
|------------------|-------------------------------|--|------------------|--------|-----|-------------------|-----|------|
| | | | Min | Typ[1] | Max | Min | Max | |
| | | $V_{CC} = 6.0\text{ V}$ | 7 | | | 8 | | ns |
| t_{su} | set-up time | nD to nCP; see Fig. 6 | | | | | | |
| | | $V_{CC} = 2.0\text{ V}$ | 75 | | | 90 | | ns |
| | | $V_{CC} = 4.5\text{ V}$ | 15 | | | 18 | | ns |
| | | $V_{CC} = 6.0\text{ V}$ | 13 | | | 15 | | ns |
| t_h | hold time | nD to nCP; see Fig. 6 | | | | | | |
| | | $V_{CC} = 2.0\text{ V}$ | 3 | | | 3 | | ns |
| | | $V_{CC} = 4.5\text{ V}$ | 3 | | | 3 | | ns |
| | | $V_{CC} = 6.0\text{ V}$ | 3 | | | 3 | | ns |
| f_{max} | maximum frequency | nCP; see Fig. 6 | | | | | | |
| | | $V_{CC} = 2.0\text{ V}$ | 4.8 | | | 4.0 | | MHz |
| | | $V_{CC} = 4.5\text{ V}$ | 24 | | | 20 | | MHz |
| | | $V_{CC} = 6.0\text{ V}$ | 28 | | | 24 | | MHz |
| C_{PD} | power dissipation capacitance | $V_I = \text{GND to } V_{CC};$ $f = 1\text{ MHz}$ [4] | | 23 | | | | pF |
| EM74HCT74 | | | | | | | | |
| t_{pd} | propagation delay | nCP to nQ, n \bar{Q} ; see Fig. 6 [2] | | | | | | |
| | | $V_{CC} = 4.5\text{ V}$ | | | 16 | | 19 | ns |
| | | n $\bar{S}D$ to nQ, n \bar{Q} ; see Fig. 7 [2] | | | | | | |
| | | $V_{CC} = 4.5\text{ V}$ | | | 16 | | 19 | ns |
| | | n $\bar{R}D$ to nQ, n \bar{Q} ; see Fig. 7 [2] | | | | | | |
| | | $V_{CC} = 4.5\text{ V}$ | | | 16 | | 19 | ns |
| t_t | transition time | nQ, n \bar{Q} ; see Fig. 6 [3] | | | | | | |
| | | $V_{CC} = 4.5\text{ V}$ | | | 6 | | 8 | ns |
| t_w | pulse width | nCP HIGH or LOW; see Fig. 6 | | | | | | |
| | | $V_{CC} = 4.5\text{ V}$ | 23 | | | 27 | | ns |
| | | n $\bar{S}D$, n $\bar{R}D$ LOW; see Fig. 7 | | | | | | |
| | | $V_{CC} = 4.5\text{ V}$ | 20 | | | 24 | | ns |
| t_{rec} | recovery time | n $\bar{S}D$, n $\bar{R}D$; see Fig. 7 | | | | | | |
| | | $V_{CC} = 4.5\text{ V}$ | 8 | | | 9 | | ns |

EM74HC74; EM74HCT74

Dual D-type flip-flop with set and reset; positive edge-trigger

| Symbol | Parameter | Conditions | -40 °C to +85 °C | | | -40 °C to +125 °C | | Unit |
|------------------|-------------------------------|---|------------------|--------|-----|-------------------|-----|------|
| | | | Min | Typ[1] | Max | Min | Max | |
| t _{su} | set-up time | nD to nCP; see Fig. 6 | | | | | | |
| | | V _{CC} = 4.5 V | 15 | | | 18 | | ns |
| t _h | hold time | nD to nCP; see Fig. 6 | | | | | | |
| | | V _{CC} = 4.5 V | 3 | | | 3 | | ns |
| f _{max} | maximum frequency | nCP; see Fig. 6 | | | | | | |
| | | V _{CC} = 4.5 V | 22 | | | 18 | | MHz |
| C _{PD} | power dissipation capacitance | V _I = GND to V _{CC} ; f = 1MHz [4] | | 24 | | | | pF |

[1] Typical values are measured at T_{amb} = 25 °C.

[2] t_{pd} is the same as t_{PLH} and t_{PHL}.

[3] t_t is the same as t_{THL} and t_{TLH}.

[4] C_{PD} is used to determine the dynamic power dissipation (P_D in μW).

$$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \sum(C_L \times V_{CC}^2 \times f_o) \text{ where:}$$

f_i = input frequency in MHz;

f_o = output frequency in MHz;

C_L = output load capacitance in pF;

V_{CC} = supply voltage in V;

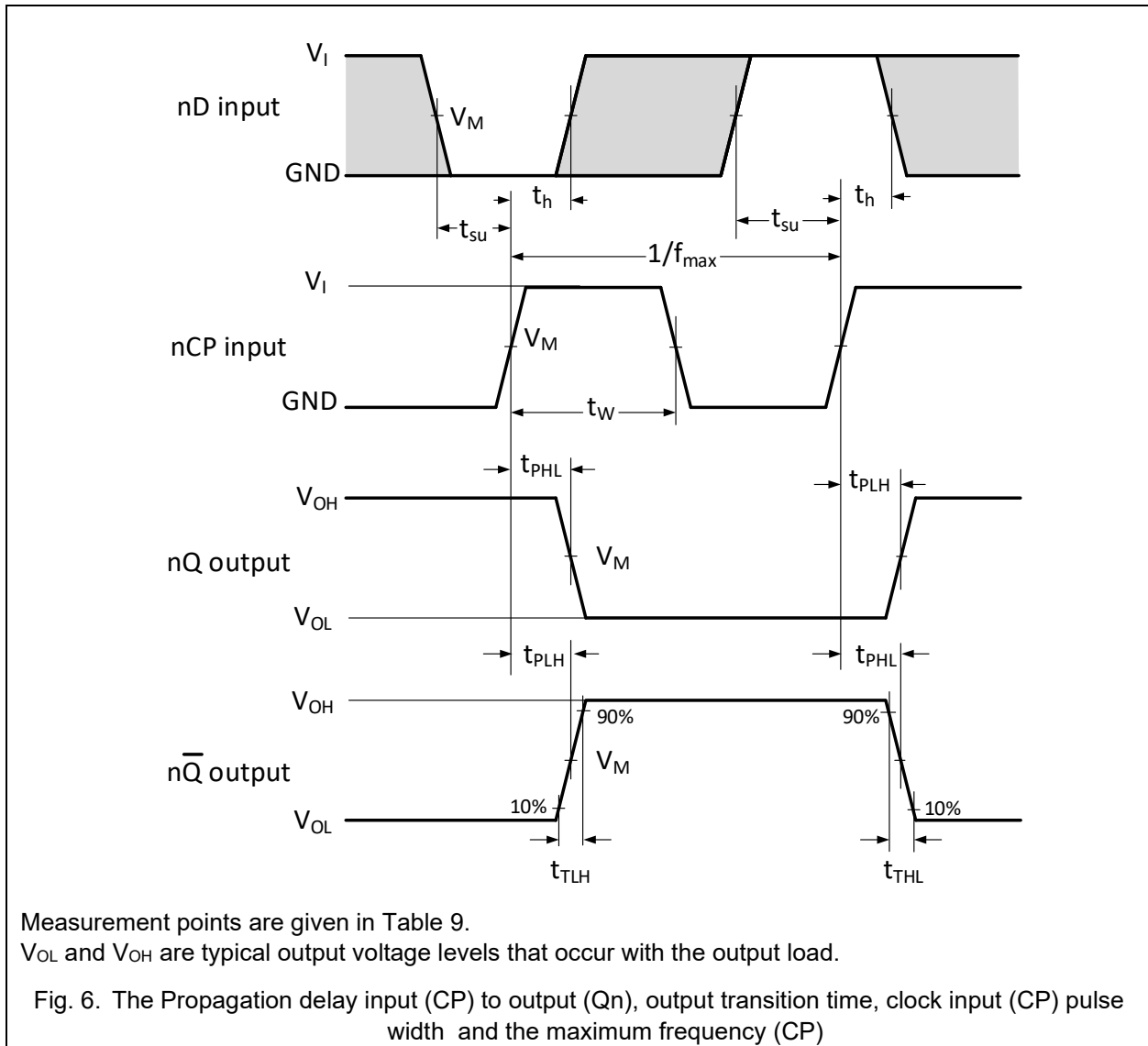
N = number of inputs switching;

∑(C_L × V_{CC}² × f_o) = sum of outputs.

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Dual D-type flip-flop with set and reset; positive edge-trigger

10.1. Waveforms and test circuit



EM74HC74; EM74HCT74

Dual D-type flip-flop with set and reset; positive edge-trigger

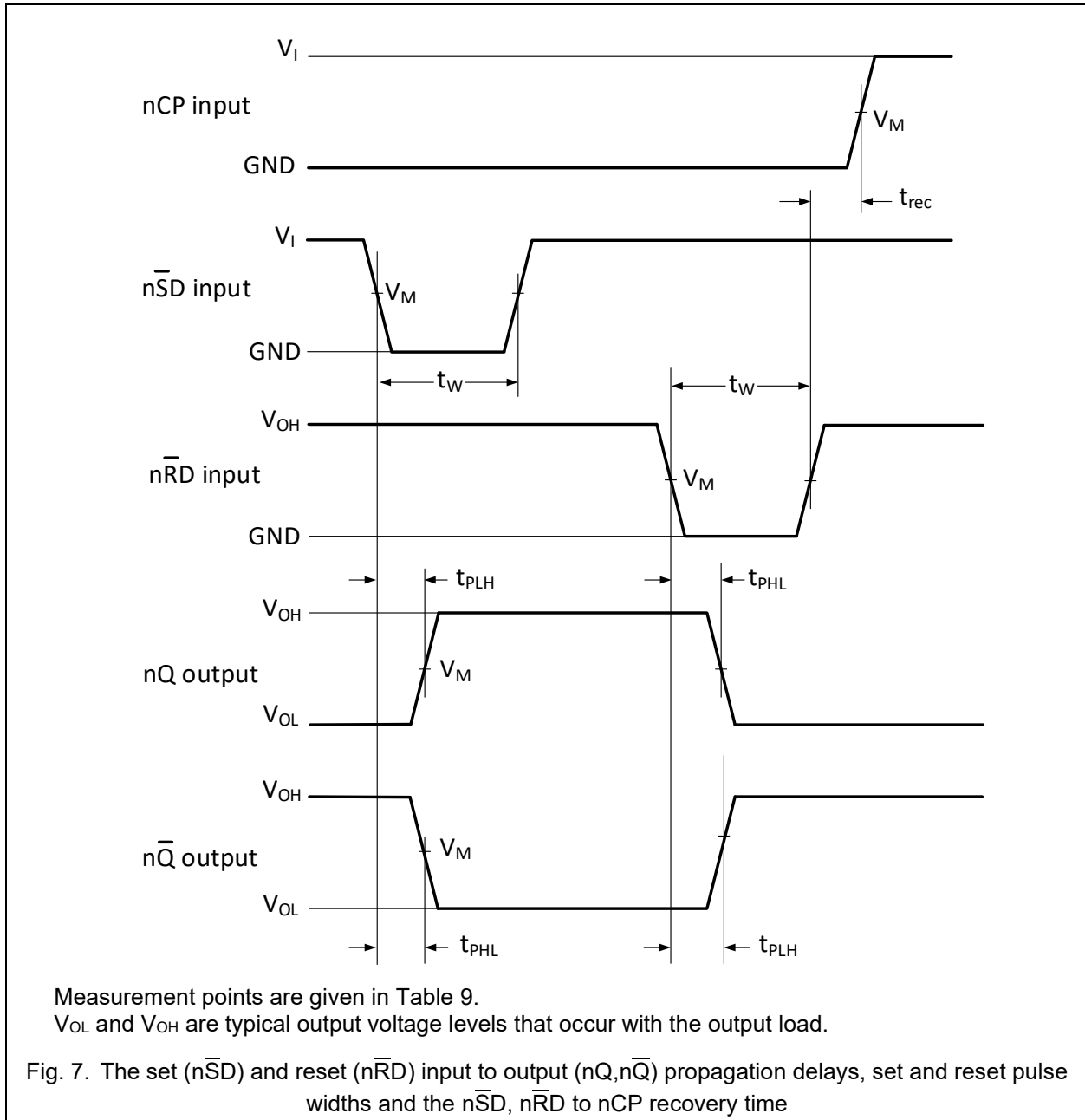


Table 9. Measurement points

| Type | Input | Output |
|-----------|-------------|-------------|
| | V_M | V_M |
| EM74HC74 | $0.5V_{CC}$ | $0.5V_{CC}$ |
| EM74HCT74 | 1.3V | 1.3V |

EM74HC74; EM74HCT74

Dual D-type flip-flop with set and reset; positive edge-trigger

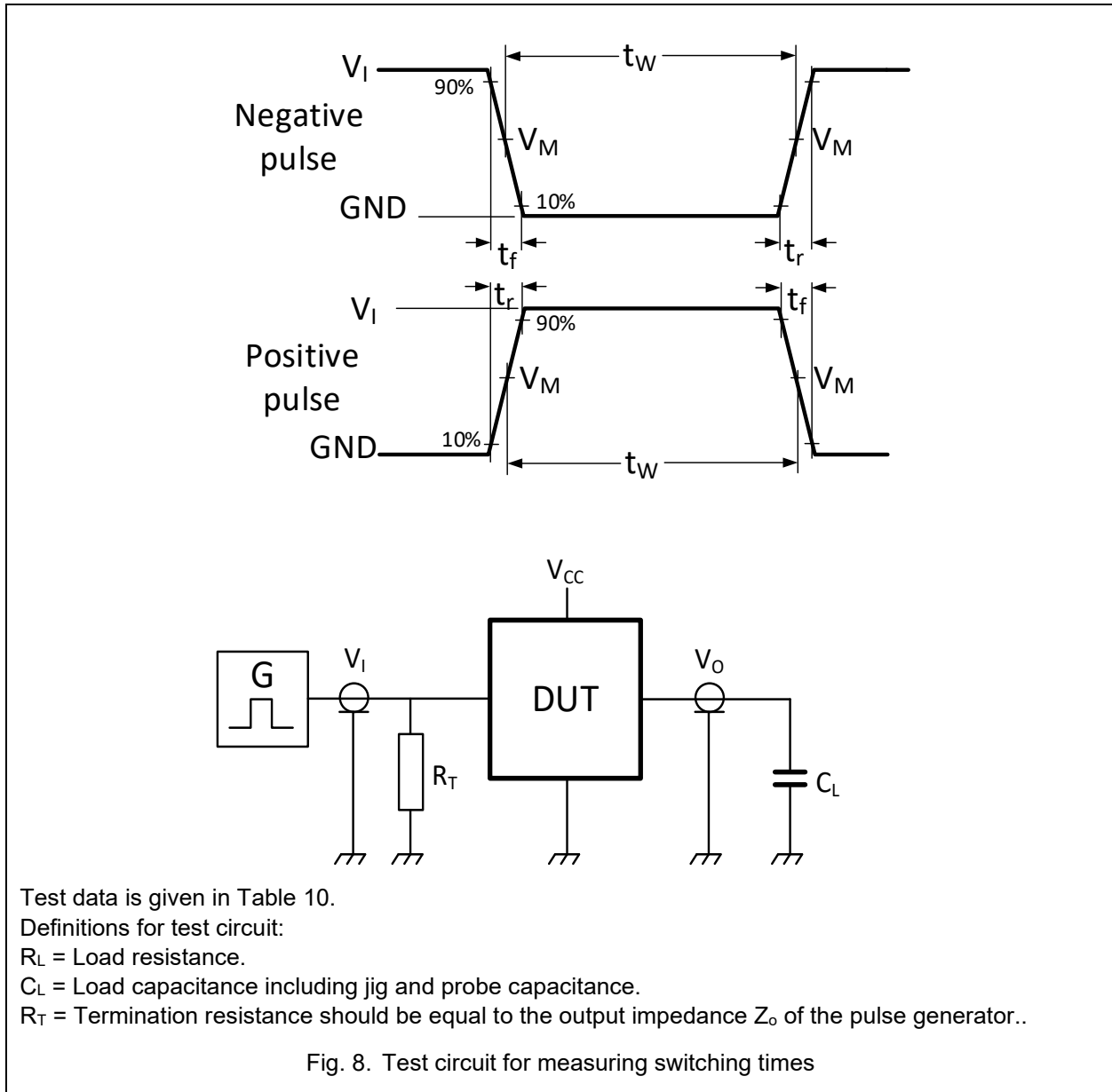


Table 10. Test data

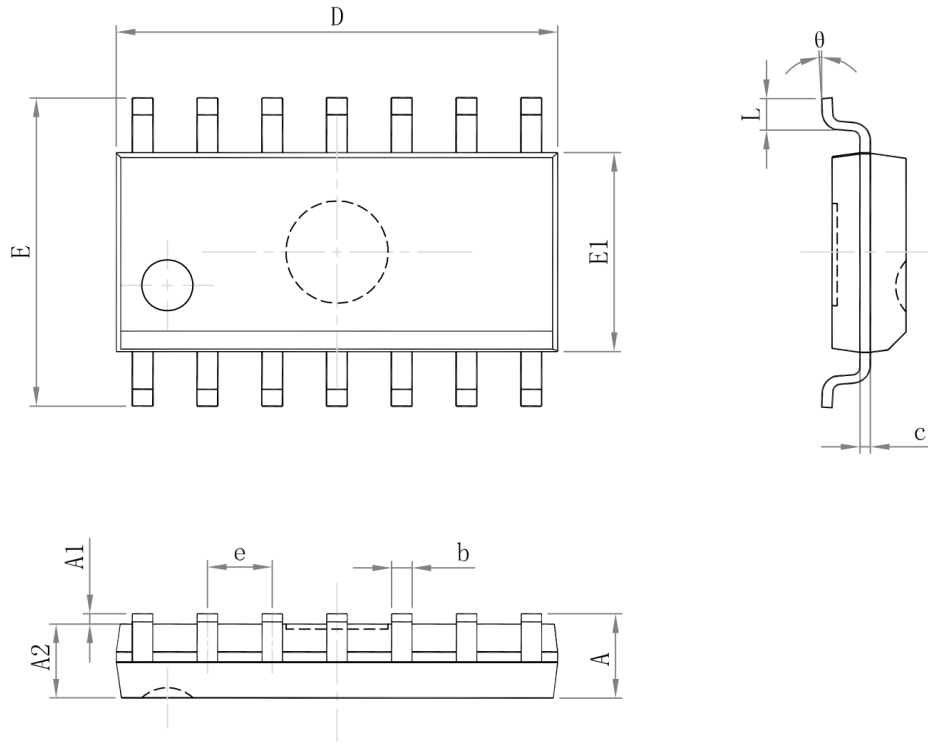
| Type | Input | | Load | Test |
|-----------|----------|---------------|-------|-----------------------|
| | V_I | $t_r = t_f$ | C_L | |
| EM74HC74 | V_{CC} | ≤ 2.5 ns | 15 pF | t_{PLH} , t_{PHL} |
| EM74HCT74 | 3 V | ≤ 2.5 ns | 15 pF | t_{PLH} , t_{PHL} |

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Dual D-type flip-flop with set and reset; positive edge-trigger

11. Package Outline

SOP-14L

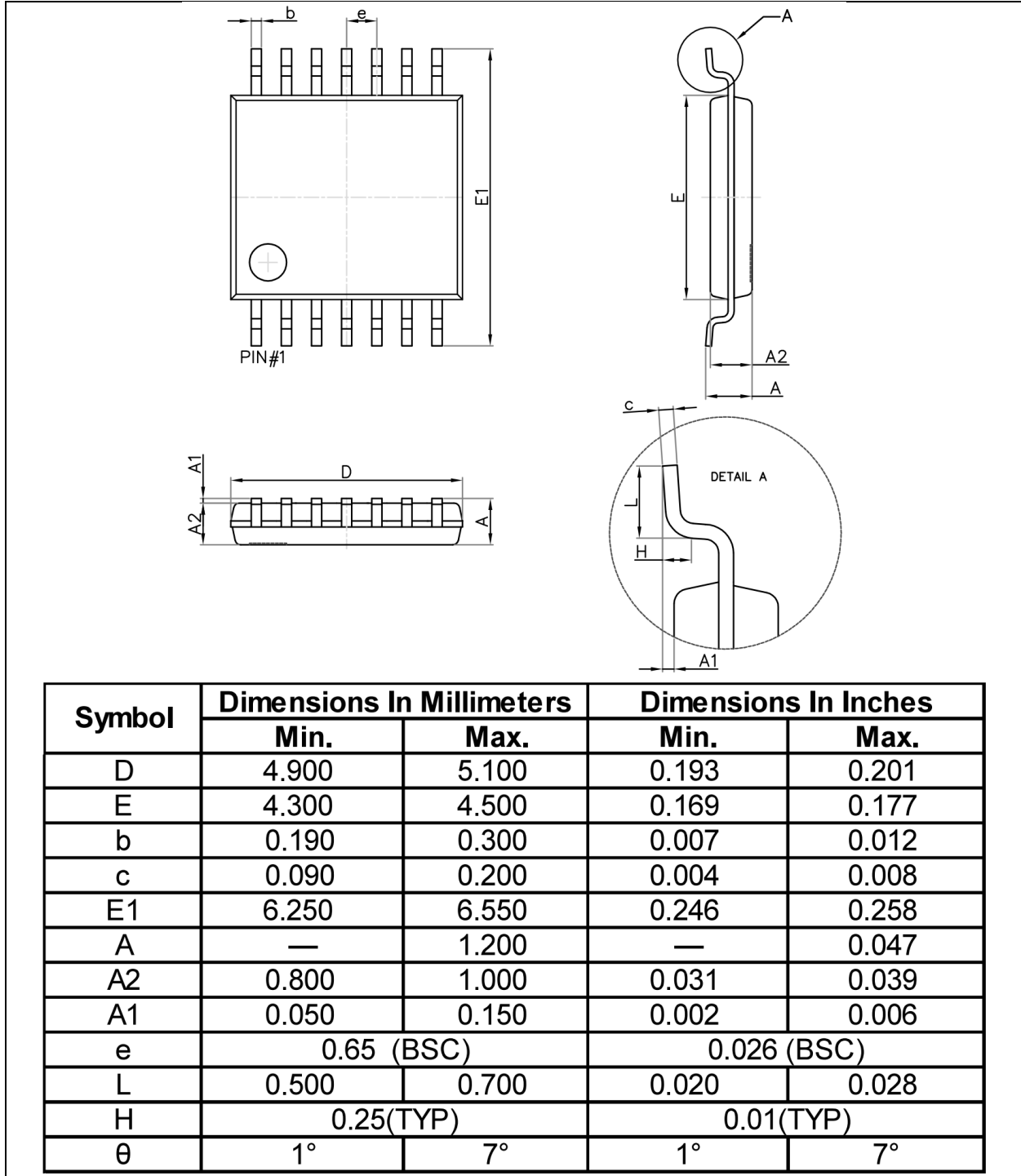


| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|--------|---------------------------|-------|----------------------|-------|
| | Min | Max | Min | Max |
| A | — | 1.750 | — | 0.069 |
| A1 | 0.100 | 0.250 | 0.004 | 0.010 |
| A2 | 1.250 | — | 0.049 | — |
| b | 0.310 | 0.510 | 0.012 | 0.020 |
| c | 0.100 | 0.250 | 0.004 | 0.010 |
| D | 8.450 | 8.850 | 0.333 | 0.348 |
| E | 5.800 | 6.200 | 0.228 | 0.244 |
| E1 | 3.800 | 4.000 | 0.150 | 0.157 |
| e | 1.270(BSC) | | 0.050(BSC) | |
| L | 0.400 | 1.270 | 0.016 | 0.050 |
| θ | 0° | 8° | 0° | 8° |

EM74HC74; EM74HCT74

Dual D-type flip-flop with set and reset; positive edge-trigger

TSSOP-14L



12. Tape and Reel Information

12.1. Carrier tape dimensions

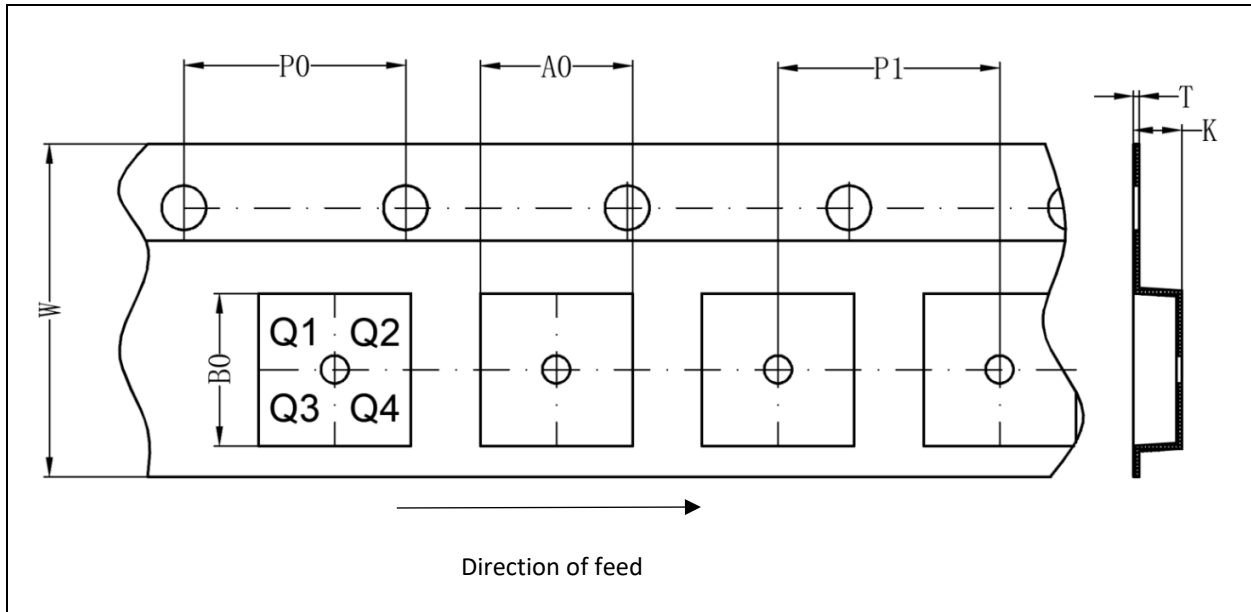


Table 11. Carrier tape dimensions

| Package version | A0(mm) | B0(mm) | K0(mm) | T(mm) | P1(mm) | W(mm) | P0(mm) | PIN 1 |
|-----------------|--------|--------|--------|-------|--------|-------|--------|-------|
| SOP-14L | 6.35 | 9.1 | 1.9 | 0.22 | 8 | 16 | 4 | Q1 |
| TSSOP-14L | 6.7 | 5.45 | 1.6 | 0.25 | 8 | 12 | 4 | Q1 |

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Dual D-type flip-flop with set and reset; positive edge-trigger

12.2. Reel and box dimensions

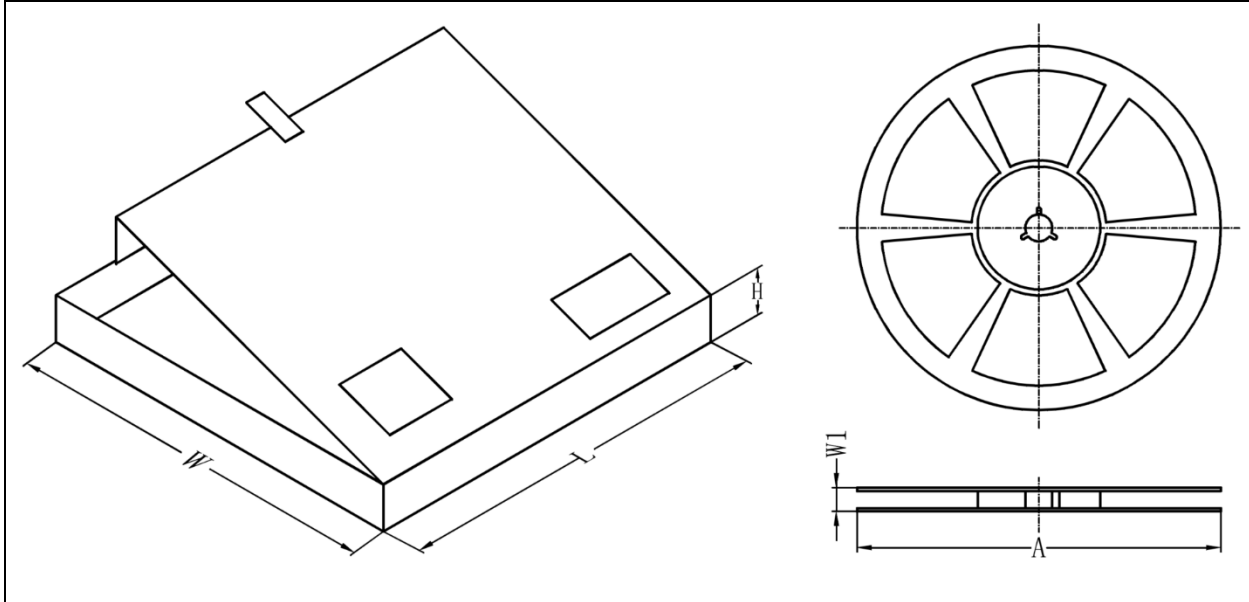


Table 12. Dimensions and quantities

| Package version | Type NO. ending | Reel Dimension A (mm) | Reel Width W1 (mm) | SPQ (pcs) [1] | Reels per box | Outer box dimensions L×W×H(mm) [2] |
|-----------------|-----------------|-----------------------|--------------------|---------------|---------------|------------------------------------|
| SOP-14L | D | 330 | 22.4 | 3000 | 1 | 358x340x50 |
| TSSOP-14L | PW | 330 | 18.4 | 3000 | 1 | 358x340x50 |

[1] Packing quantity dependent on specific product type. Please contact your local Energymath representative for ordering.

[2] Dimensions for reference only.

EM74HC74; EM74HCT74

Dual D-type flip-flop with set and reset; positive edge-trigger

13. Abbreviations

Table 13. Abbreviations

| Acronym | Description |
|---------|---|
| CMOS | Complementary Metal-Oxide Semiconductor |
| DUT | Device Under Test |
| ESD | ElectroStatic Discharge |
| HBM | Human Body Model |
| CDM | Charged Device Model |
| TTL | Transistor-Transistor Logic |

14. Revision History

Table 14. Revision history

| Document ID | Release Date | Data sheet status | Change notice | Supersedes |
|-------------------------|---|-------------------|---------------|-----------------------|
| EM74HC_HCT74 Rev. 1.2 | Mar 17, 2026 | Product datasheet | | EM74HC_HCT74 Rev. 1.1 |
| Modifications: | <ul style="list-style-type: none"> Section 12 added Tape and Reel Information. | | | |
| EM74HC_HCT74 Rev. 1.1 | Dec 15, 2025 | Product datasheet | | EM74HC_HCT74 Rev. 1.0 |
| Modifications: | <ul style="list-style-type: none"> Table 1: topside marking information updated. | | | |
| EM74HC74_HCT74 Rev. 1.0 | Aug 28, 2024 | Product datasheet | | |