



MC74AC74 MC74ACT74

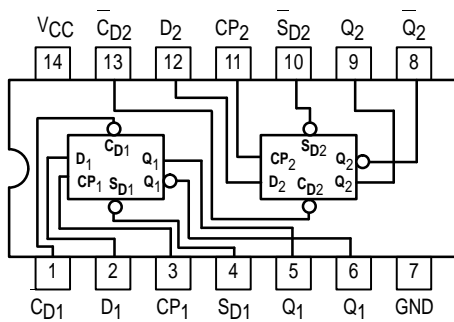
Dual D-Type Positive Edge-Triggered Flip-Flop

The MC74AC74/74ACT74 is a dual D-type flip-flop with Asynchronous Clear and Set inputs and complementary (Q, \bar{Q}) outputs. Information at the input is transferred to the outputs on the positive edge of the clock pulse. Clock triggering occurs at a voltage level of the clock pulse and is not directly related to the transition time of the positive-going pulse. After the Clock Pulse input threshold voltage has been passed, the Data input is locked out and information present will not be transferred to the outputs until the next rising edge of the Clock Pulse input.

Asynchronous Inputs:

- LOW input to \bar{S}_D (Set) sets Q to HIGH level
- LOW input to \bar{C}_D (Clear) sets Q to LOW level
- Clear and Set are independent of clock
- Simultaneous LOW on \bar{C}_D and \bar{S}_D makes both Q and \bar{Q} HIGH

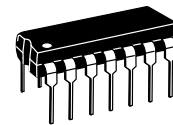
- Outputs Source/Sink 24 mA
- 'ACT74 Has TTL Compatible Inputs



PIN NAMES

- D₁, D₂ Data Inputs
- CP₁, CP₂ Clock Pulse Inputs
- \bar{C}_D ₁, \bar{C}_D ₂ Direct Clear Inputs
- \bar{S}_D ₁, \bar{S}_D ₂ Direct Set Inputs
- Q₁, Q₁, Q₂, \bar{Q}_2 Outputs

DUAL D-TYPE POSITIVE
EDGE-TRIGGERED
FLIP-FLOP

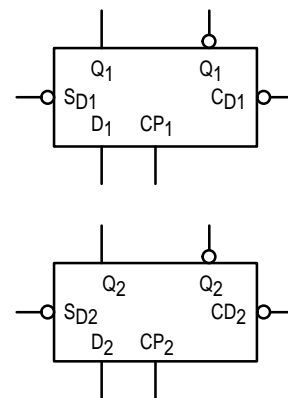


N SUFFIX
CASE 646-06
PLASTIC



D SUFFIX
CASE 751A-03
PLASTIC

LOGIC SYMBOL



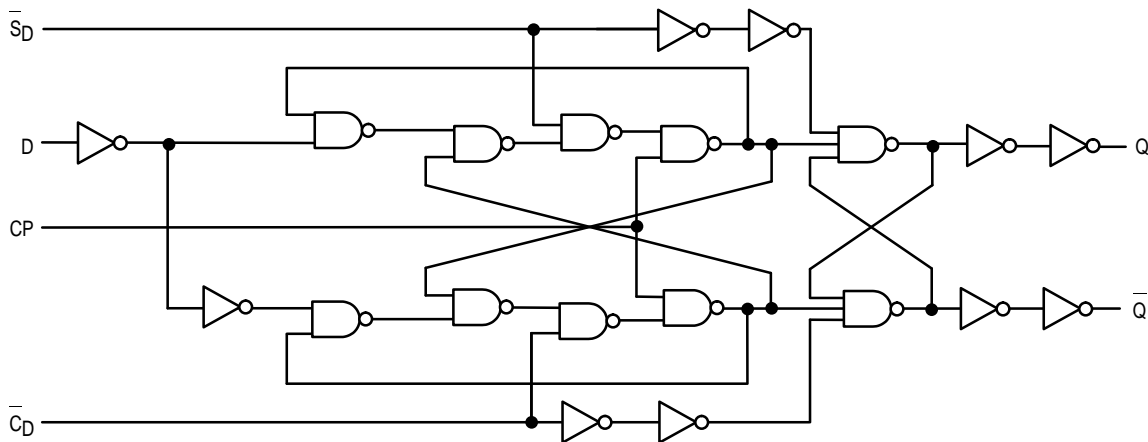
TRUTH TABLE (Each Half)

| Inputs | | | | Outputs | |
|-------------|-------------|----|---|----------------|-------------|
| \bar{S}_D | \bar{C}_D | CP | 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 |

H = HIGH Voltage Level
L = LOW Voltage Level
X = Immaterial
┐ = LOW-to-HIGH Clock Transition
Q₀(\bar{Q}_0) = Previous Q(Q) before LOW-to-HIGH Transition of Clock

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LOGIC DIAGRAM



Please note that this diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

MAXIMUM RATINGS*

| Symbol | Parameter | Value | Unit |
|------------------|--|------------------------------|------|
| V _{CC} | DC Supply Voltage (Referenced to GND) | -0.5 to +7.0 | V |
| V _{in} | DC Input Voltage (Referenced to GND) | -0.5 to V _{CC} +0.5 | V |
| V _{out} | DC Output Voltage (Referenced to GND) | -0.5 to V _{CC} +0.5 | V |
| I _{in} | DC Input Current, per Pin | ±20 | mA |
| I _{out} | DC Output Sink/Source Current, per Pin | ±50 | mA |
| I _{CC} | DC V _{CC} or GND Current per Output Pin | ±50 | mA |
| T _{stg} | Storage Temperature | -65 to +150 | °C |

* Maximum Ratings are those values beyond which damage to the device may occur. Functional operation should be restricted to the Recommended Operating Conditions.

RECOMMENDED OPERATING CONDITIONS

| Symbol | Parameter | Min | Typ | Max | Unit | |
|------------------------------------|---|-------------------------|-----|-----------------|------|------|
| V _{CC} | Supply Voltage | 'AC | 2.0 | 5.0 | 6.0 | V |
| | | 'ACT | 4.5 | 5.0 | 5.5 | |
| V _{in} , V _{out} | DC Input Voltage, Output Voltage (Ref. to GND) | 0 | | V _{CC} | V | |
| t _r , t _f | Input Rise and Fall Time (Note 1) 'AC Devices except Schmitt Inputs | V _{CC} @ 3.0 V | | 150 | | ns/V |
| | | V _{CC} @ 4.5 V | | 40 | | |
| | | V _{CC} @ 5.5 V | | 25 | | |
| t _r , t _f | Input Rise and Fall Time (Note 2) 'ACT Devices except Schmitt Inputs | V _{CC} @ 4.5 V | | 10 | | ns/V |
| | | V _{CC} @ 5.5 V | | 8.0 | | |
| T _J | Junction Temperature (PDIP) | | | 140 | °C | |
| T _A | Operating Ambient Temperature Range | -40 | 25 | 85 | °C | |
| I _{OH} | Output Current — High | | | -24 | mA | |
| I _{OL} | Output Current — Low | | | 24 | mA | |

1. V_{in} from 30% to 70% V_{CC}; see individual Data Sheets for devices that differ from the typical input rise and fall times.

2. V_{in} from 0.8 V to 2.0 V; see individual Data Sheets for devices that differ from the typical input rise and fall times.

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DC CHARACTERISTICS

| Symbol | Parameter | V _{CC} (V) | 74AC | | 74AC | | Unit | Conditions |
|------------------|--------------------------------------|------------------------|------------------------|-------------------|------------------------------------|--|------|---|
| | | | T _A = +25°C | | T _A = -40°C to +85°C | | | |
| | | | Typ | Guaranteed Limits | | | | |
| V _{IH} | Minimum High Level Input Voltage | 3.0 | 1.5 | 2.1 | 2.1 | | V | V _{OUT} = 0.1 V or V _{CC} - 0.1 V |
| | | 4.5 | 2.25 | 3.15 | 3.15 | | | |
| | | 5.5 | 2.75 | 3.85 | 3.85 | | | |
| V _{IL} | Maximum Low Level Input Voltage | 3.0 | 1.5 | 0.9 | 0.9 | | V | V _{OUT} = 0.1 V or V _{CC} - 0.1 V |
| | | 4.5 | 2.25 | 1.35 | 1.35 | | | |
| | | 5.5 | 2.75 | 1.65 | 1.65 | | | |
| V _{OH} | Minimum High Level Output Voltage | 3.0 | 2.99 | 2.9 | 2.9 | | V | I _{OUT} = -50 μA |
| | | 4.5 | 4.49 | 4.4 | 4.4 | | | |
| | | 5.5 | 5.49 | 5.4 | 5.4 | | | |
| | | 3.0 | | 2.56 | 2.46 | | V | *V _{IN} = V _{IL} or V _{IH} -12 mA I _{OH} -24 mA -24 mA |
| | | 4.5 | | 3.86 | 3.76 | | | |
| | | 5.5 | | 4.86 | 4.76 | | | |
| V _{OL} | Maximum Low Level Output Voltage | 3.0 | 0.002 | 0.1 | 0.1 | | V | I _{OUT} = 50 μA |
| | | 4.5 | 0.001 | 0.1 | 0.1 | | | |
| | | 5.5 | 0.001 | 0.1 | 0.1 | | | |
| | | 3.0 | | 0.36 | 0.44 | | V | *V _{IN} = V _{IL} or V _{IH} 12 mA I _{OL} 24 mA 24 mA |
| | | 4.5 | | 0.36 | 0.44 | | | |
| | | 5.5 | | 0.36 | 0.44 | | | |
| I _{IN} | Maximum Input Leakage Current | 5.5 | | ±0.1 | ±1.0 | | μA | V _I = V _{CC} , GND |
| I _{OLD} | †Minimum Dynamic Output Current | 5.5 | | | 75 | | mA | V _{OLD} = 1.65 V Max |
| I _{OHD} | | 5.5 | | | -75 | | mA | V _{OHD} = 3.85 V Min |
| I _{CC} | Maximum Quiescent Supply Current | 5.5 | | 4.0 | 40 | | μA | V _{IN} = V _{CC} or GND |

* All outputs loaded; thresholds on input associated with output under test.

† Maximum test duration 2.0 ms, one output loaded at a time.

Note: I_{IN} and I_{CC} @ 3.0 V are guaranteed to be less than or equal to the respective limit @ 5.5 V V_{CC}.

AC CHARACTERISTICS (For Figures and Waveforms — See Section 3)

| Symbol | Parameter | V _{CC} * (V) | 74AC | | | 74AC | | Unit | Fig. No. |
|------------------|---|--------------------------|--|------|------|--|------|------|-------------|
| | | | T _A = +25°C C _L = 50 pF | | | T _A = -40°C to +85°C C _L = 50 pF | | | |
| | | | Min | Typ | Max | Min | Max | | |
| f _{max} | Maximum Clock Frequency | 3.3 | 100 | 125 | | 95 | MHz | 3-3 | |
| | | 5.0 | 140 | 160 | | 125 | | | |
| t _{PLH} | Propagation Delay — C _{Dn} or S _{Dn} to Q _n or Q _n | 3.3 | 5.0 | 8.0 | 12.5 | 4.0 | 13.0 | ns | 3-6 |
| | | 5.0 | 3.5 | 6.0 | 9.0 | 3.0 | 10.0 | | |
| t _{PHL} | Propagation Delay — C _{Dn} or S _{Dn} to Q _n or Q _n | 3.3 | 4.0 | 10.5 | 12.0 | 3.5 | 13.5 | ns | 3-6 |
| | | 5.0 | 3.0 | 8.0 | 9.5 | 2.5 | 10.5 | | |
| t _{PLH} | Propagation Delay C _{Pn} to Q _n or Q _n | 3.3 | 4.5 | 8.0 | 13.5 | 4.0 | 16.0 | ns | 3-6 |
| | | 5.0 | 3.5 | 6.0 | 10.0 | 3.0 | 10.5 | | |
| t _{PHL} | Propagation Delay C _{Pn} to Q _n or Q _n | 3.3 | 3.5 | 8.0 | 14.0 | 3.5 | 14.5 | ns | 3-6 |
| | | 5.0 | 2.5 | 6.0 | 10.0 | 2.5 | 10.5 | | |

* Voltage Range 3.3 V is 3.3 V ± 0.3 V.

Voltage Range 5.0 V is 5.0 V ± 0.5 V.

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AC OPERATING REQUIREMENTS

| Symbol | Parameter | V _{CC} * (V) | 74AC | | 74AC | | Unit | Fig. No. |
|------------------|--|--------------------------|--|--------------------|--|----|------|----------|
| | | | T _A = +25°C C _L = 50 pF | | T _A = -40°C to +85°C C _L = 50 pF | | | |
| | | | Typ | Guaranteed Minimum | | | | |
| t _s | Set-up Time, HIGH or LOW D _n to CP _n | 3.3 | 1.5 | 4.0 | 4.5 | ns | 3-9 | |
| | | 5.0 | 1.0 | 3.0 | 3.0 | | | |
| t _h | Hold Time, HIGH or LOW D _n to CP _n | 3.3 | -2.0 | 0.5 | 0.5 | ns | 3-9 | |
| | | 5.0 | -1.5 | 0.5 | 0.5 | | | |
| t _w | CP _n or \overline{C} D _n or \overline{S} D _n Pulse Width | 3.3 | 3.0 | 5.5 | 7.0 | ns | 3-6 | |
| | | 5.0 | 2.5 | 4.5 | 5.0 | | | |
| t _{rec} | Recovery Time C _{Dn} or \overline{S} D _n to CP | 3.3 | -2.5 | 0 | 0 | ns | 3-9 | |
| | | 5.0 | -2.0 | 0 | 0 | | | |

* Voltage Range 3.3 V is 3.3 V ±0.3 V.
Voltage Range 5.0 V is 5.0 V ±0.5 V.

DC CHARACTERISTICS

| Symbol | Parameter | V _{CC} (V) | 74ACT | | 74ACT | | Unit | Conditions |
|-------------------|--|------------------------|------------------------|-------------------|------------------------------------|------------------------|---|------------|
| | | | T _A = +25°C | | T _A = -40°C to +85°C | | | |
| | | | Typ | Guaranteed Limits | | | | |
| V _{IH} | Minimum High Level Input Voltage | 4.5 | 1.5 | 2.0 | 2.0 | V | V _{OUT} = 0.1 V or V _{CC} - 0.1 V | |
| | | 5.5 | 1.5 | 2.0 | 2.0 | | | |
| V _{IL} | Maximum Low Level Input Voltage | 4.5 | 1.5 | 0.8 | 0.8 | V | V _{OUT} = 0.1 V or V _{CC} - 0.1 V | |
| | | 5.5 | 1.5 | 0.8 | 0.8 | | | |
| V _{OH} | Minimum High Level Output Voltage | 4.5 | 4.49 | 4.4 | 4.4 | V | I _{OUT} = -50 μA | |
| | | 5.5 | 5.49 | 5.4 | 5.4 | | | |
| | | 4.5 | | 3.86 | 3.76 | V | *V _{IN} = V _{IL} or V _{IH} -24 mA | |
| 5.5 | | 4.86 | 4.76 | | V | I _{OH} -24 mA | | |
| V _{OL} | Maximum Low Level Output Voltage | 4.5 | 0.001 | 0.1 | 0.1 | V | I _{OUT} = 50 μA | |
| | | 5.5 | 0.001 | 0.1 | 0.1 | | | |
| | | 4.5 | | 0.36 | 0.44 | V | *V _{IN} = V _{IL} or V _{IH} 24 mA | |
| 5.5 | | 0.36 | 0.44 | | V | I _{OL} 24 mA | | |
| I _{IN} | Maximum Input Leakage Current | 5.5 | | ±0.1 | ±1.0 | μA | V _I = V _{CC} , GND | |
| ΔI _{CCT} | Additional Max. I _{CC} /Input | 5.5 | 0.6 | | 1.5 | mA | V _I = V _{CC} - 2.1 V | |
| I _{OLD} | †Minimum Dynamic Output Current | 5.5 | | | 75 | mA | V _{OLD} = 1.65 V Max | |
| I _{OHD} | | 5.5 | | | -75 | mA | V _{OHD} = 3.85 V Min | |
| I _{CC} | Maximum Quiescent Supply Current | 5.5 | | 4.0 | 40 | μA | V _{IN} = V _{CC} or GND | |

* All outputs loaded; thresholds on input associated with output under test.

† Maximum test duration 2.0 ms, one output loaded at a time.

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AC CHARACTERISTICS (For Figures and Waveforms — See Section 3)

| Symbol | Parameter | V _{CC} * (V) | 74ACT | | | 74ACT | | Unit | Fig. No. |
|------------------|---|-----------------------|--|-----|------|--|------|------|----------|
| | | | T _A = +25°C C _L = 50 pF | | | T _A = -40°C to +85°C C _L = 50 pF | | | |
| | | | Min | Typ | Max | Min | Max | | |
| f _{max} | Maximum Clock Frequency | 5.0 | 145 | 210 | | 125 | | MHz | 3-3 |
| t _{PLH} | Propagation Delay — C _{Dn} or S _{Dn} to Q _n or Q _n | 5.0 | 3.0 | 5.5 | 9.5 | 2.5 | 10.5 | ns | 3-6 |
| t _{PHL} | Propagation Delay — C _{Dn} or S _{Dn} to Q _n or Q _n | 5.0 | 3.0 | 6.0 | 10.0 | 3.0 | 11.5 | ns | 3-6 |
| t _{PLH} | Propagation Delay C _{Pn} to Q _n or Q _n | 5.0 | 4.0 | 7.5 | 11.0 | 4.0 | 13.0 | ns | 3-6 |
| t _{PHL} | Propagation Delay C _{Pn} to Q _n or Q _n | 5.0 | 3.5 | 6.0 | 10.0 | 3.0 | 11.5 | ns | 3-6 |

* Voltage Range 5.0 V is 5.0 V ±0.5 V.

AC OPERATING REQUIREMENTS

| Symbol | Parameter | V _{CC} * (V) | 74ACT | | 74ACT | | Unit | Fig. No. |
|------------------|--|-----------------------|--|--------------------|--|--|------|----------|
| | | | T _A = +25°C C _L = 50 pF | | T _A = -40°C to +85°C C _L = 50 pF | | | |
| | | | Typ | Guaranteed Minimum | | | | |
| t _s | Set-up Time, HIGH or LOW D _n to CP _n | 5.0 | 1.0 | 3.0 | 3.5 | | ns | 3-9 |
| t _h | Hold Time, HIGH or LOW D _n to CP _n | 5.0 | -0.5 | 1.0 | 1.0 | | ns | 3-9 |
| t _w | C _{Pn} or C _{Dn} or S _{Dn} Pulse Width | 5.0 | 3.0 | 5.0 | 6.0 | | ns | 3-6 |
| t _{rec} | Recovery Time C _{Dn} or S _{Dn} to CP | 5.0 | -2.5 | 0 | 0 | | ns | 3-9 |

* Voltage Range 5.0 V is 5.0 V ±0.5 V.

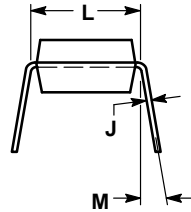
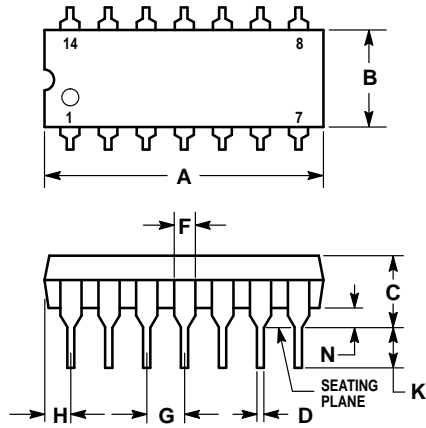
CAPACITANCE

| Symbol | Parameter | Value Typ | Unit | Test Conditions |
|-----------------|-------------------------------|-----------|------|-------------------------|
| C _{IN} | Input Capacitance | 4.5 | pF | V _{CC} = 5.0 V |
| C _{PD} | Power Dissipation Capacitance | 35 | pF | V _{CC} = 5.0 V |

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OUTLINE DIMENSIONS

N SUFFIX PLASTIC DIP PACKAGE CASE 646-06 ISSUE L

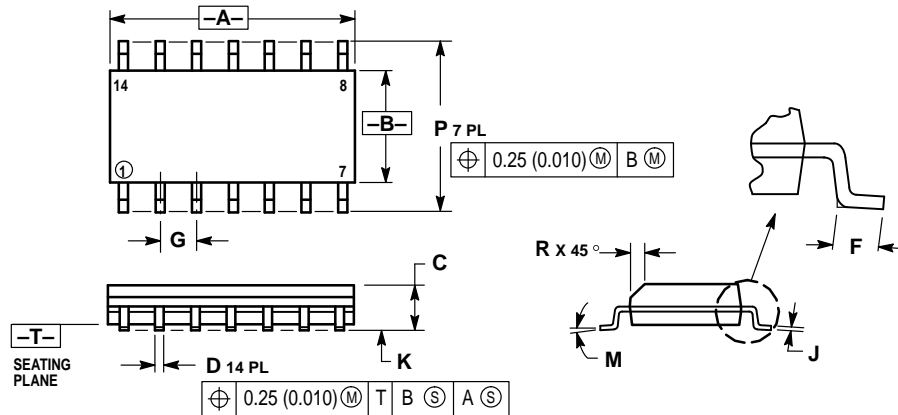


NOTES:

- LEADS WITHIN 0.13 (0.005) RADIUS OF TRUE POSITION AT SEATING PLANE AT MAXIMUM MATERIAL CONDITION.
- DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
- DIMENSION B DOES NOT INCLUDE MOLD FLASH.
- ROUNDED CORNERS OPTIONAL.

| DIM | INCHES | | MILLIMETERS | |
|-----|-----------|-------|-------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 0.715 | 0.770 | 18.16 | 19.56 |
| B | 0.240 | 0.260 | 6.10 | 6.60 |
| C | 0.145 | 0.185 | 3.69 | 4.69 |
| D | 0.015 | 0.021 | 0.38 | 0.53 |
| F | 0.040 | 0.070 | 1.02 | 1.78 |
| G | 0.100 BSC | | 2.54 BSC | |
| H | 0.052 | 0.095 | 1.32 | 2.41 |
| J | 0.008 | 0.015 | 0.20 | 0.38 |
| K | 0.115 | 0.135 | 2.92 | 3.43 |
| L | 0.300 BSC | | 7.62 BSC | |
| M | 0° | 10° | 0° | 10° |
| N | 0.015 | 0.039 | 0.39 | 1.01 |


D SUFFIX PLASTIC SOIC PACKAGE CASE 751A-03 ISSUE F



NOTES:

- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
- CONTROLLING DIMENSION: MILLIMETER.
- DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
- MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
- DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

| DIM | MILLIMETERS | | INCHES | |
|-----|-------------|------|-----------|-------|
| | MIN | MAX | MIN | MAX |
| A | 8.55 | 8.75 | 0.337 | 0.344 |
| B | 3.80 | 4.00 | 0.150 | 0.157 |
| C | 1.35 | 1.75 | 0.054 | 0.068 |
| D | 0.35 | 0.49 | 0.014 | 0.019 |
| F | 0.40 | 1.25 | 0.016 | 0.049 |
| G | 1.27 BSC | | 0.050 BSC | |
| J | 0.19 | 0.25 | 0.008 | 0.009 |
| K | 0.10 | 0.25 | 0.004 | 0.009 |
| M | 0° | 7° | 0° | 7° |
| P | 5.80 | 6.20 | 0.228 | 0.244 |
| R | 0.25 | 0.50 | 0.010 | 0.019 |

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MC74AC74/D

