

54F/74F74 Dual D-Type Positive Edge-Triggered Flip-Flop

General Description

The 'F74 is a dual D-type flip-flop with Direct 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 sets Q to HIGH level
 LOW input to \bar{C}_D 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

Features

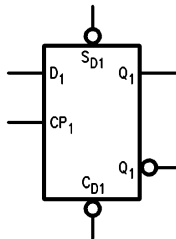
- Guaranteed 4000V minimum ESD protection

| Commercial | Military | Package Number | Package Description |
|------------------|------------------|----------------|---|
| 74F74PC | | N14A | 14-Lead (0.300" Wide) Molded Dual-In-Line |
| | 54F74DM (Note 2) | J14A | 14-Lead Ceramic Dual-In-Line |
| 74F74SC (Note 1) | | M14A | 14-Lead (0.150" Wide) Molded Small Outline, JEDEC |
| 74F74SJ (Note 1) | | M14D | 14-Lead (0.300" Wide) Molded Small Outline, EIAJ |
| | 54F74FM (Note 2) | W14B | 14-Lead Cerpack |
| | 54F74LM (Note 2) | E20A | 20-Lead Ceramic Leadless Chip Carrier, Type C |

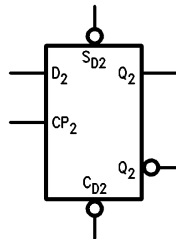
Note 1: Devices also available in 13" reel. Use Suffix = SCX.

Note 2: Military grade device with environmental and burn-in processing. Use suffix = DMQB, FMQB and LMQB.

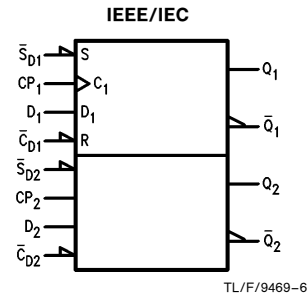
Logic Symbols



TL/F/9469-3



TL/F/9469-4

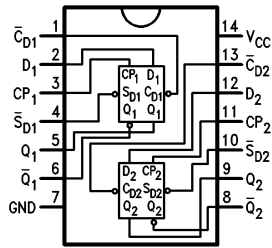


TL/F/9469-6

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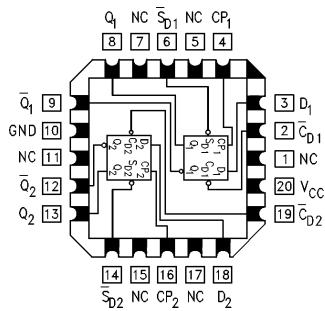
Connection Diagrams

Pin Assignment
for DIP, SOIC, and Flatpak



TL/F/9469-1

Pin Assignment
for LCC



TL/F/9469-2

Unit Loading/Fan Out

| Pin Names | Description | 54F/74F | |
|---|---|------------------|---|
| | | U.L. HIGH/LOW | Input I _{IH} /I _{IL} Output I _{OH} /I _{OL} |
| D ₁ , D ₂ | Data Inputs | 1.0/1.0 | 20 μA/ -0.6 mA |
| CP ₁ , CP ₂ | Clock Pulse Inputs (Active Rising Edge) | 1.0/1.0 | 20 μA/ -0.6 mA |
| \bar{C}_{D1} , \bar{C}_{D2} | Direct Clear Inputs (Active LOW) | 1.0/3.0 | 20 μA/ -1.8 mA |
| \bar{S}_{D1} , \bar{S}_{D2} | Direct Set Inputs (Active LOW) | 1.0/3.0 | 20 μA/ -1.8 mA |
| Q ₁ , \bar{Q}_1 , Q ₂ , \bar{Q}_2 | Outputs | 50/33.3 | -1 mA/20 mA |

Truth Table

| 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 (h) = HIGH Voltage Level

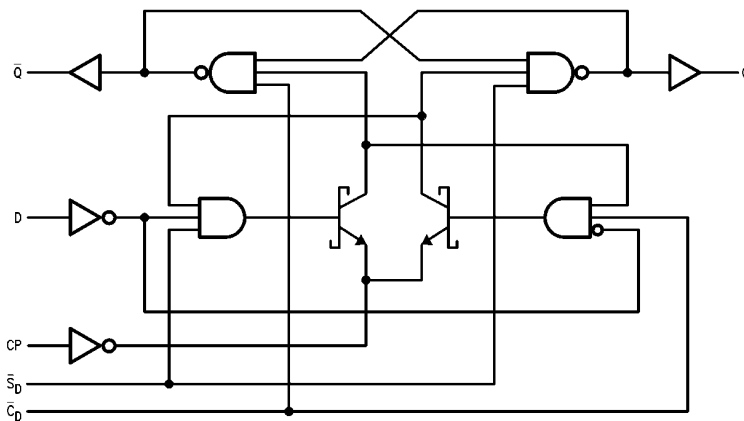
L (l) = LOW Voltage Level

X = Immaterial

Q₀ = Previous Q (\bar{Q}) before LOW-to-HIGH Clock Transition

Lower case letters indicate the state of the referenced input or output one setup time prior to the LOW-to-HIGH clock transition.

Logic Diagram



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

Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

| | |
|---|--------------------------------------|
| Storage Temperature | -65°C to +150°C |
| Ambient Temperature under Bias | -55°C to +125°C |
| Junction Temperature under Bias | -55°C to +175°C |
| Plastic | -55°C to +150°C |
| V _{CC} Pin Potential to Ground Pin | -0.5V to +7.0V |
| Input Voltage (Note 2) | -0.5V to +7.0V |
| Input Current (Note 2) | -30 mA to +5.0 mA |
| Voltage Applied to Output in HIGH State (with V _{CC} = 0V) | |
| Standard Output | -0.5V to V _{CC} |
| TRI-STATE® Output | -0.5V to +5.5V |
| Current Applied to Output in LOW State (Max) | twice the rated I _{OL} (mA) |
| ESD Last Passing Voltage (Min) | 4000V |

Note 1: Absolute maximum ratings are values beyond which the device may be damaged or have its useful life impaired. Functional operation under these conditions is not implied.

Note 2: Either voltage limit or current limit is sufficient to protect inputs.

Recommended Operating Conditions

| | |
|------------------------------|-----------------|
| Free Air Ambient Temperature | |
| Military | -55°C to +125°C |
| Commercial | 0°C to +70°C |
| Supply Voltage | |
| Military | +4.5V to +5.5V |
| Commercial | +4.5V to +5.5V |

DC Electrical Characteristics

| Symbol | Parameter | 54F/74F | | | Units | V _{CC} | Conditions |
|------------------|-----------------------------------|-------------------------|------|--------------|-------|-----------------|--|
| | | Min | Typ | Max | | | |
| V _{IH} | Input HIGH Voltage | 2.0 | | | V | | Recognized as a HIGH Signal |
| V _{IL} | Input LOW Voltage | | | 0.8 | V | | Recognized as a LOW Signal |
| V _{CD} | Input Clamp Diode Voltage | | | -1.2 | V | Min | I _{IN} = -18 mA |
| V _{OH} | Output HIGH Voltage | 54F 10% V _{CC} | 2.5 | | V | Min | I _{OH} = -1 mA I _{OH} = -1 mA I _{OH} = -1 mA |
| | | 74F 10% V _{CC} | 2.5 | | | | |
| | | 74F 5% V _{CC} | 2.7 | | | | |
| V _{OL} | Output LOW Voltage | 54F 10% V _{CC} | | 0.5 | V | Min | I _{OL} = 20 mA I _{OL} = 20 mA |
| | | 74F 10% V _{CC} | | 0.5 | | | |
| I _{IH} | Input HIGH Current | 54F | | 20.0 | μA | Max | V _{IN} = 2.7V |
| | | 74F | | 5.0 | | | |
| I _{BVI} | Input HIGH Current Breakdown Test | 54F | | 100 | μA | Max | V _{IN} = 7.0V |
| | | 74F | | 7.0 | | | |
| I _{CEX} | Output HIGH Leakage Current | 54F | | 250 | μA | Max | V _{OUT} = V _{CC} |
| | | 74F | | 50 | | | |
| V _{ID} | Input Leakage Test | 74F | 4.75 | | V | 0.0 | I _{ID} = 1.9 μA All Other Pins Grounded |
| I _{OD} | Output Leakage Circuit Current | 74F | | 3.75 | μA | 0.0 | V _{IOD} = 150 mV All Other Pins Grounded |
| I _{IL} | Input LOW Current | | | -0.6 -1.8 | mA | Max | V _{IN} = 0.5V (D, CP) V _{IN} = 0.5V (\overline{C}_D , \overline{S}_D) |
| I _{OS} | Output Short-Circuit Current | | | -60 -150 | mA | Max | V _{OUT} = 0V |
| I _{CC} | Power Supply Current | | 10.5 | 16.0 | mA | Max | |

AC Electrical Characteristics

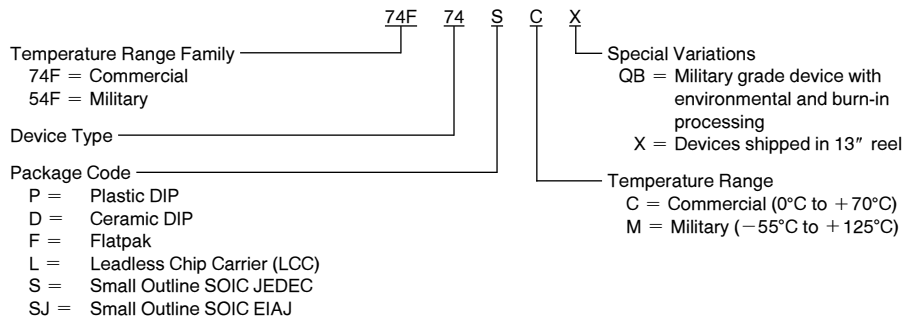
| Symbol | Parameter | 74F | | | 54F | | 74F | | Units |
|------------------|---|---|-----|-----|--|------|--|------|-------|
| | | T _A = +25°C V _{CC} = +5.0V C _L = 50 pF | | | T _A , V _{CC} = Mil C _L = 50 pF | | T _A , V _{CC} = Com C _L = 50 pF | | |
| | | Min | Typ | Max | Min | Max | Min | Max | |
| f _{max} | Maximum Clock Frequency | 100 | 125 | | 80 | | 100 | | MHz |
| t _{PLH} | Propagation Delay | 3.8 | 5.3 | 6.8 | 3.8 | 8.5 | 3.8 | 7.8 | ns |
| t _{PHL} | CP _n to Q _n or \bar{Q}_n | 4.4 | 6.2 | 8.0 | 4.4 | 10.5 | 4.4 | 9.2 | |
| t _{PLH} | Propagation Delay | 3.2 | 4.6 | 6.1 | 3.2 | 8.0 | 3.2 | 7.1 | ns |
| t _{PHL} | \bar{C}_{Dn} or \bar{S}_{Dn} to Q _n or \bar{Q}_n | 3.5 | 7.0 | 9.0 | 3.5 | 11.5 | 3.5 | 10.5 | |

AC Operating Requirements

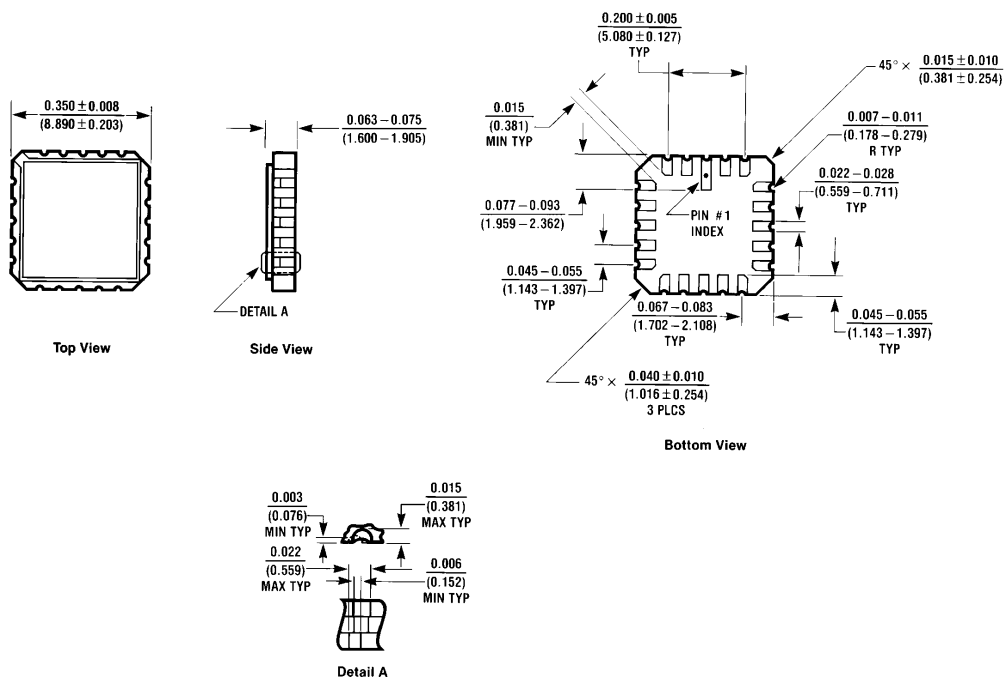
| Symbol | Parameter | 74F | | 54F | | 74F | | Units |
|--------------------|--|---|-----|--|-----|--|-----|-------|
| | | T _A = +25°C V _{CC} = +5.0V | | T _A , V _{CC} = Mil | | T _A , V _{CC} = Com | | |
| | | Min | Max | Min | Max | Min | Max | |
| t _s (H) | Setup Time, HIGH or LOW | 2.0 | | 3.0 | | 2.0 | | ns |
| t _s (L) | D _n to CP _n | 3.0 | | 4.0 | | 3.0 | | |
| t _h (H) | Hold Time, HIGH or LOW | 1.0 | | 2.0 | | 1.0 | | ns |
| t _h (L) | D _n to CP _n | 1.0 | | 2.0 | | 1.0 | | |
| t _w (H) | CP _n Pulse Width | 4.0 | | 4.0 | | 4.0 | | ns |
| t _w (L) | HIGH or LOW | 5.0 | | 6.0 | | 5.0 | | |
| t _w (L) | \bar{C}_{Dn} or \bar{S}_{Dn} Pulse Width | 4.0 | | 4.0 | | 4.0 | | ns |
| t _{rec} | Recovery Time | 2.0 | | 3.0 | | 2.0 | | ns |
| | \bar{C}_{Dn} or \bar{S}_{Dn} to CP | | | | | | | |

Ordering Information

The device number is used to form part of a simplified purchasing code where the package type and temperature range are defined as follows:



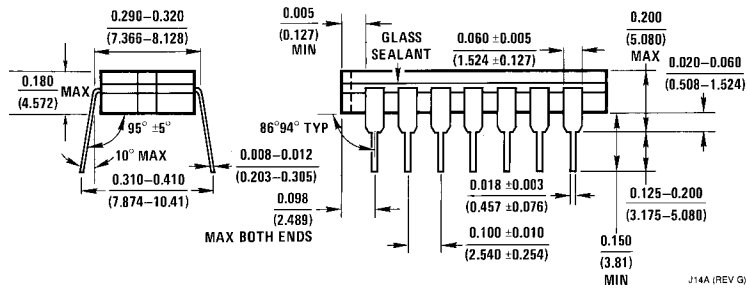
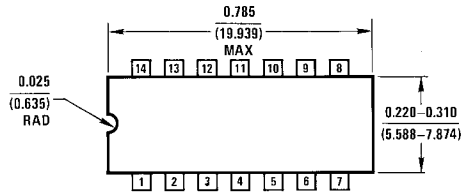
Physical Dimensions inches (millimeters)



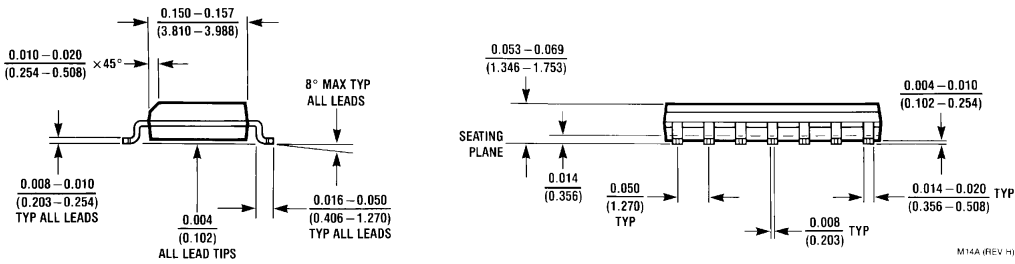
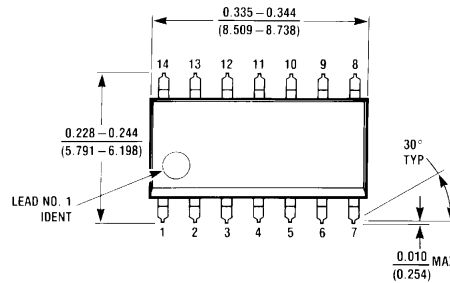
20-Lead Ceramic Leadless Chip Carrier (L)
NS Package Number E20A

E20A (REV D)

Physical Dimensions inches (millimeters) (Continued)

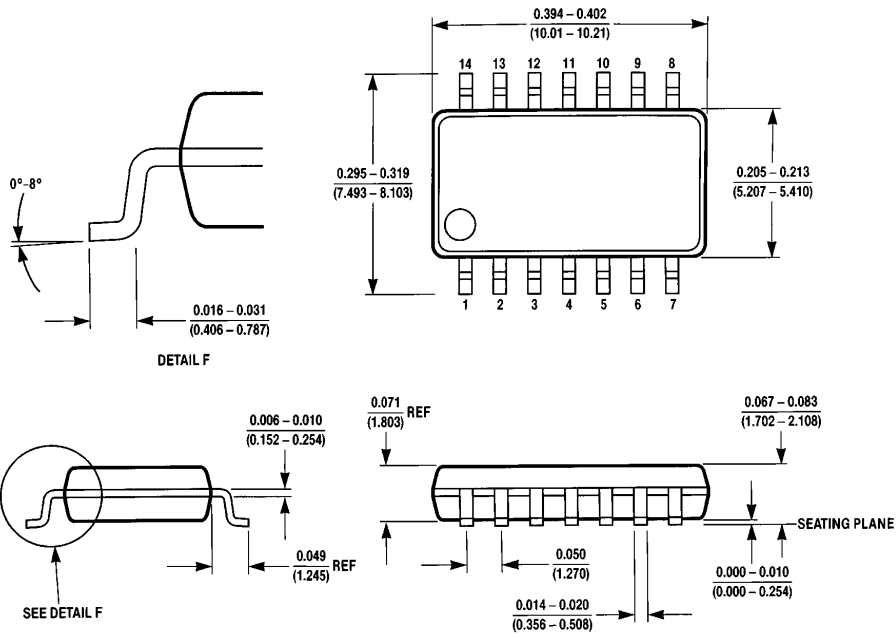


14-Lead Ceramic Dual-In-Line Package (D)
NS Package Number J14A



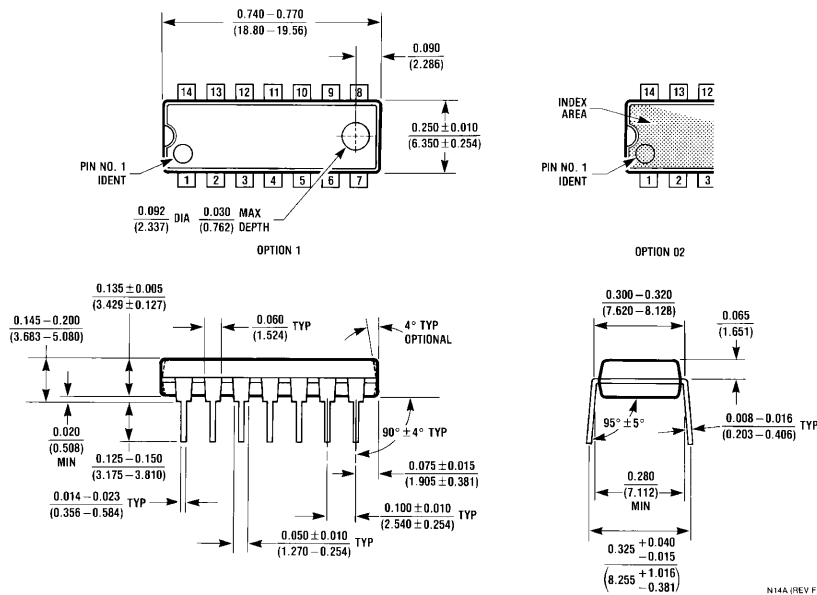
14-Lead (0.150" Wide) Molded Small Outline, JEDEC (S)
NS Package Number M14A

Physical Dimensions inches (millimeters) (Continued)



M14D (REV A)

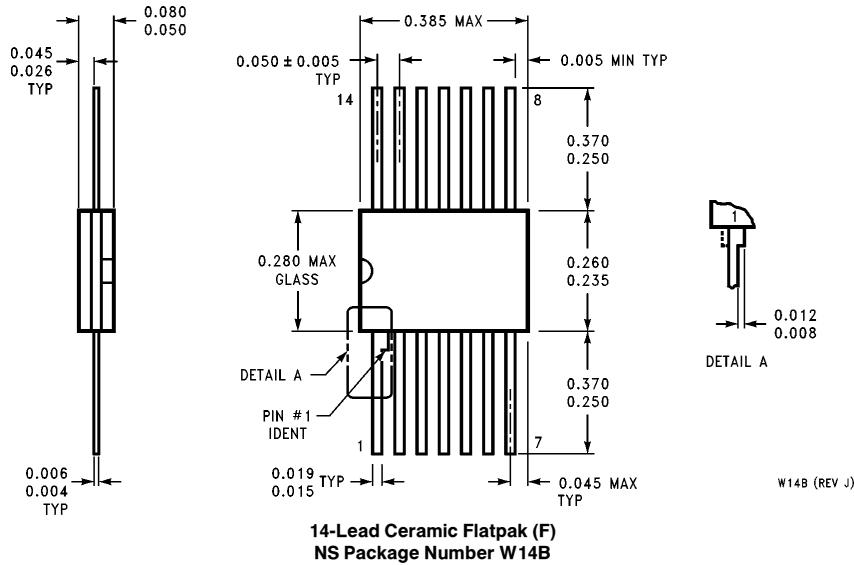
**14-Lead (0.300" Wide) Molded Small Outline, EIAJ (SJ)
NS Package Number M14D**



N14A (REV F)

**14-Lead (0.300" Wide) Molded Dual-In-Line Package (P)
NS Package Number N14A**

Physical Dimensions inches (millimeters) (Continued)



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