National Semiconductor

December 1994

# 54F/74F08
# Quad 2-Input AND Gate

## General Description

This device contains four independent gates, each of which performs the logic AND function.

## Features

- Guaranteed 4000V minimum ESD protection

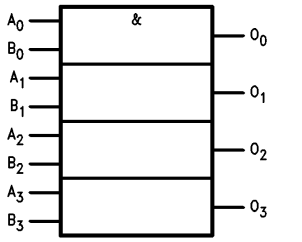
| Commercial | Military | Package Number | Package Description |
|---|---|---|---|
| 74F08PC | | N14A | 14-Lead (0.300″ Wide) Molded Dual-In-Line |
| | 54F08DM (Note 2) | J14A | 14-Lead Ceramic Dual-In-Line |
| 74F08SC (Note 1) | | M14A | 14-Lead (0.150″ Wide) Molded Small Outline, JEDEC |
| 74F08SJ (Note 1) | | M14D | 14-Lead (0.300″ Wide) Molded Small Outline, EIAJ |
| | 54F08FM (Note 2) | W14B | 14-Lead Cerpack |
| | 54F08LM (Note 2) | E20A | 20-Lead Ceramic Leadless Chip Carrier, Type C |

**Note 1:** Devices also available in 13″ reel. Use suffix = SCX and SJX.

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

## Logic Symbol

**IEEE/IEC**

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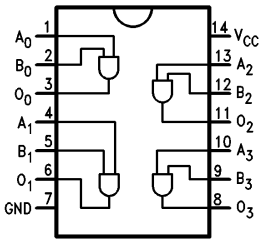
## Connection Diagrams

**Pin Assignment for DIP, SOIC and Flatpak**

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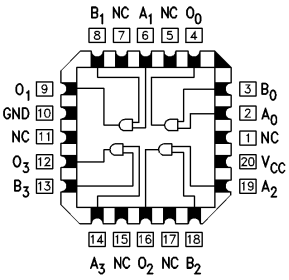
**Pin Assignment for LCC**

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## Unit Loading/Fan Out

| Pin Names | Description | 54F/74F | |
|---|---|---|---|
| | | U.L. HIGH/LOW | Input $I_{IH}/I_{IL}$ Output $I_{OH}/I_{OL}$ |
| $A_n$, $B_n$ | Inputs | 1.0/1.0 | 20 μA/−0.6 mA |
| $O_n$ | Outputs | 50/33.3 | −1 mA/20 mA |

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## 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 Min | 54F/74F Typ | 54F/74F Max | Units | $V_{CC}$ | Conditions |
|---|---|---|---|---|---|---|---|---|
| $V_{IH}$ | 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 |
| | | 74F 10% $V_{CC}$ | 2.5 | | | | | $I_{OH}$ = −1 mA |
| | | 74F 5% $V_{CC}$ | 2.7 | | | | | $I_{OH}$ = −1 mA |
| $V_{OL}$ | Output LOW Voltage | 54F 10% $V_{CC}$ | | | 0.5 | V | Min | $I_{OL}$ = 20 mA |
| | | 74F 10% $V_{CC}$ | | | 0.5 | | | $I_{OL}$ = 20 mA |
| $I_{IH}$ | 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 | mA | Max | $V_{IN}$ = 0.5V |
| $I_{OS}$ | Output Short-Circuit Current | | −60 | | −150 | mA | Max | $V_{OUT}$ = 0V |
| $I_{CCH}$ | Power Supply Current | | | 5.5 | 8.3 | mA | Max | $V_O$ = HIGH |
| $I_{CCL}$ | Power Supply Current | | | 8.6 | 12.9 | mA | Max | $V_O$ = LOW |

## 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 | |
| $t_{PLH}$ | Propagation Delay | 3.0 | 4.2 | 5.6 | 2.5 | 7.5 | 3.0 | 6.6 | ns |
| $t_{PHL}$ | $A_n$, $B_n$ to $O_n$ | 2.5 | 4.0 | 5.3 | 2.0 | 7.5 | 2.5 | 6.3 | |

## 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:

74F 08 S C X

Temperature Range Family
- 74F = Commercial
- 54F = Military

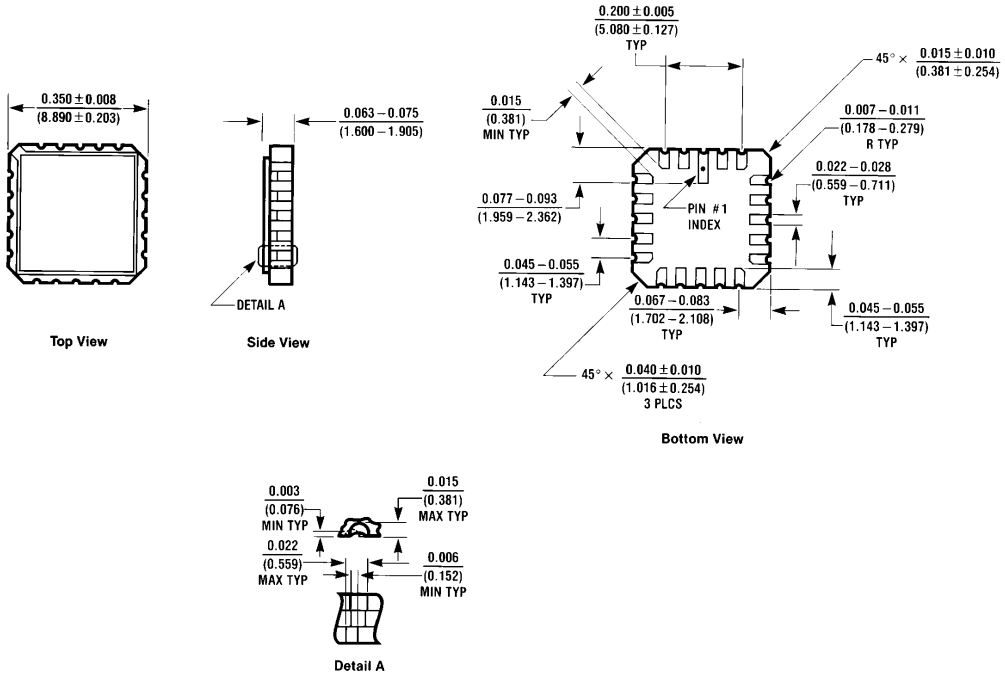
Device Type

Package Code
- P = Plastic DIP
- D = Ceramic DIP
- F = Flatpak
- L = Leadless Chip Carrier (LCC)
- S = Small Outline SOIC JEDEC
- SJ = Small Outline SOIC EIAJ

Special Variations
- QB = Military grade device with environmental and burn-in processing
- X = Devices shipped in 13″ reels

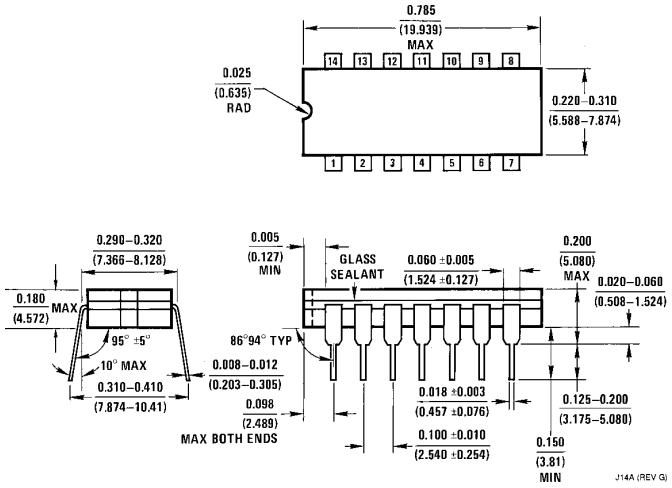
Temperature Range
- C = Commercial (0°C to +70°C)
- M = Military (−55°C to +125°C)

## Physical Dimensions inches (millimeters)

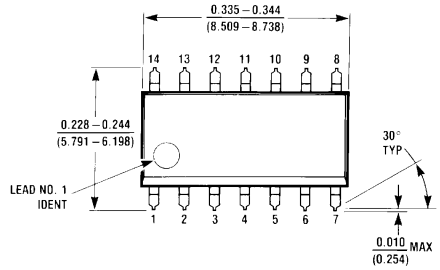


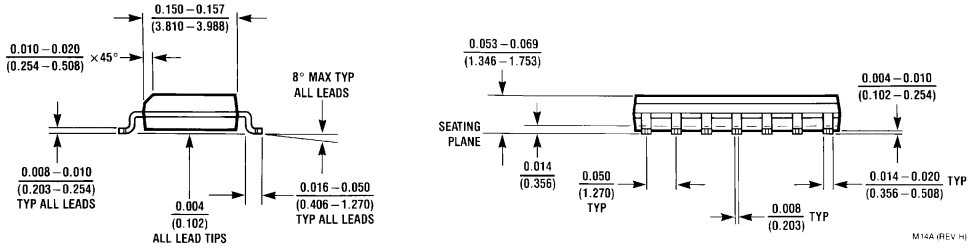

**20-Lead Ceramic Leadless Chip Carrier (L)**
**NS Package Number E20A**

## Physical Dimensions inches (millimeters) (Continued)



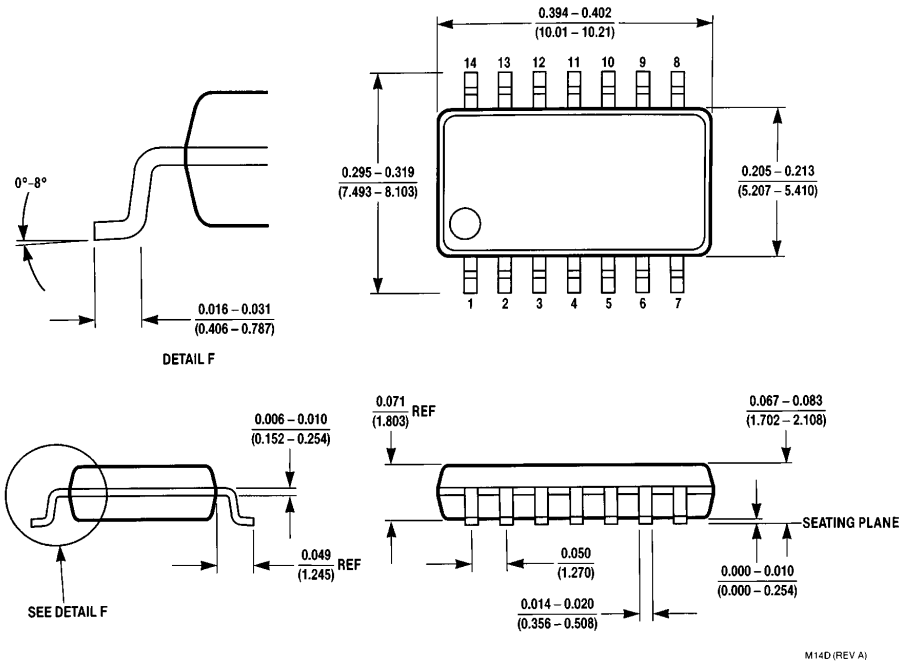

**14-Lead Ceramic Dual-In-Line Package (D)**
**NS Package Number J14A**



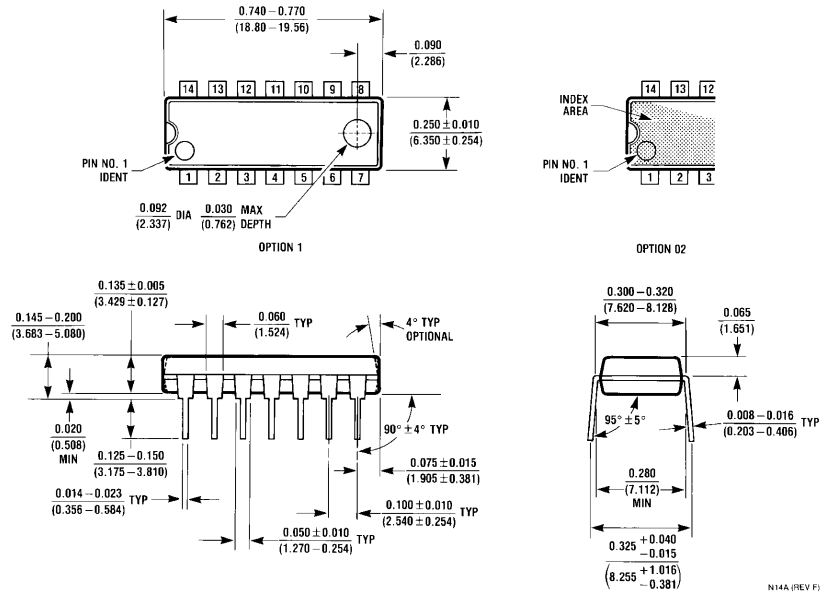




**14-Lead (0.150″ Wide) Molded Small Outline, JEDEC (S)**
**NS Package Number M14A**

## Physical Dimensions inches (millimeters) (Continued)

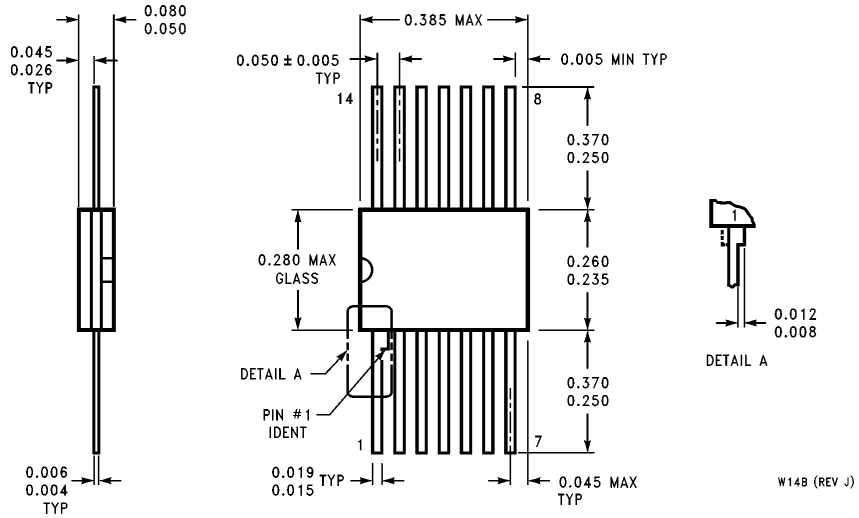



**14-Lead (0.300″ Wide) Molded Small Outline, EIAJ (SJ)**
**NS Package Number M14D**




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

## Physical Dimensions inches (millimeters) (Continued)




**14-Lead Ceramic Flatpak (F)**
**NS Package Number W14B**

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