

## 54F/74F86 2-Input Exclusive-OR Gate

### General Description

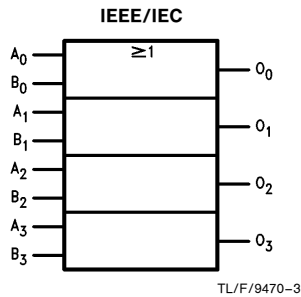
This device contains four independent gates, each of which performs the logic exclusive-OR function.

| Commercial       | Military         | Package Number | Package Description                               |
|------------------|------------------|----------------|---|
| 74F86PC          |                  | N14A           | 14-Lead (0.300" Wide) Molded Dual-in-Line         |
|                  | 54F86DM (Note 2) | J14A           | 14-Lead Ceramic Dual-in-Line                      |
| 74F86SC (Note 1) |                  | M14A           | 14-Lead (0.150" Wide) Molded Small Outline, JEDEC |
| 74F86SJ (Note 1) |                  | M14D           | 14-Lead (0.300" Wide) Molded Small Outline, EIAJ  |
|                  | 54F86FM (Note 2) | W14B           | 14-Lead Cerpack                                   |
|                  | 54F86LM (Note 2) | E20A           | 20-Lead Ceramic Leadless Chip Carrier, Type C     |

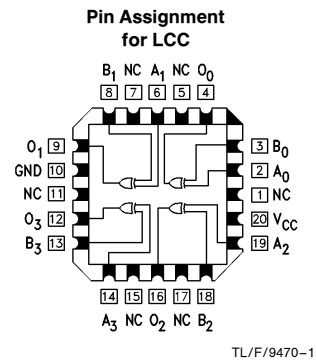
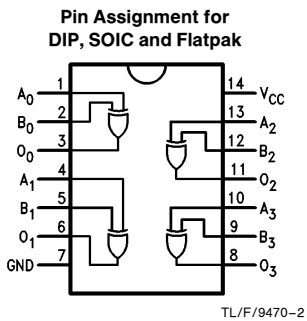
**Note 1:** Devices also available in 13" reel. Use suffix = SCX and SJX.

**Note 2:** Military grade device with environmental and burn-in processing. Use suffix = DMOB, FMOB and LMOB.

### Logic Symbol



### Connection Diagrams



### Unit Loading/Fan Out

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

TRI-STATE® is a registered trademark of National Semiconductor Corporation.

## 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 <sub>CC</sub> 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 <sub>CC</sub> = 0V) |                          |
| Standard Output   | -0.5V to V <sub>CC</sub> |
| TRI-STATE® Output   | -0.5V to +5.5V           |

Current Applied to Output in LOW State (Max) twice the rated I<sub>OL</sub> (mA)

**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

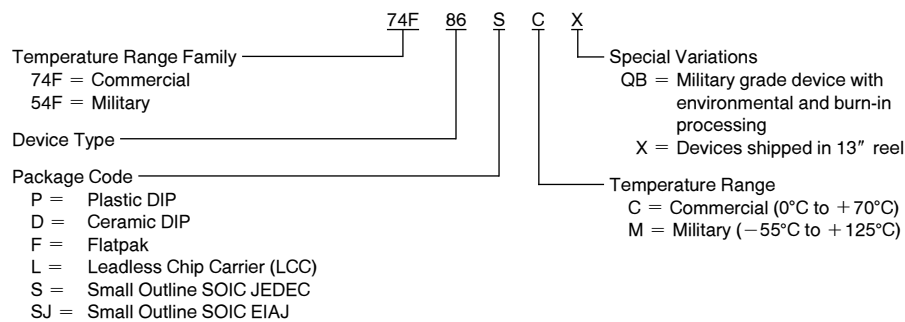
| Symbol           | Parameter                         | 54F/74F  |                   |             | Units | V <sub>CC</sub> | Conditions  |
|------------------|-----------------------------------|--|-------------------|-------------|-------|-----------------|---|
|                  |                                   | Min  | Typ               | Max         |       |                 |   |
| V <sub>IH</sub>  | Input HIGH Voltage                | 2.0  |                   |             | V     |                 | Recognized as a HIGH Signal   |
| V <sub>IL</sub>  | Input LOW Voltage                 |  |                   | 0.8         | V     |                 | Recognized as a LOW Signal  |
| V <sub>CD</sub>  | Input Clamp Diode Voltage         |  |                   | -1.2        | V     | Min             | I <sub>IN</sub> = -18 mA  |
| V <sub>OH</sub>  | Output HIGH Voltage               | 54F 10% V <sub>CC</sub><br>74F 10% V <sub>CC</sub><br>74F 5% V <sub>CC</sub> | 2.5<br>2.5<br>2.7 |             | V     | Min             | I <sub>OH</sub> = -1 mA<br>I <sub>OH</sub> = -1 mA<br>I <sub>OH</sub> = -1 mA |
| V <sub>OL</sub>  | Output LOW Voltage                | 54F 10% V <sub>CC</sub><br>74F 10% V <sub>CC</sub>                           |                   | 0.5<br>0.5  | V     | Min             | I <sub>OL</sub> = 20 mA<br>I <sub>OL</sub> = 20 mA                            |
| I <sub>IH</sub>  | Input HIGH Current                | 54F<br>74F   |                   | 20.0<br>5.0 | μA    | Max             | V <sub>IN</sub> = 2.7V  |
| I <sub>BVI</sub> | Input HIGH Current Breakdown Test | 54F<br>74F   |                   | 100<br>7.0  | μA    | Max             | V <sub>IN</sub> = 7.0V  |
| I <sub>CEX</sub> | Output HIGH Leakage Current       | 54F<br>74F   |                   | 250<br>50   | μA    | Max             | V <sub>OUT</sub> = V <sub>CC</sub>  |
| V <sub>ID</sub>  | Input Leakage Test                | 74F  | 4.75              |             | V     | 0.0             | I <sub>ID</sub> = 1.9 μA<br>All other pins grounded                           |
| I <sub>OD</sub>  | Output Leakage Circuit Current    | 74F  |                   | 3.75        | μA    | 0.0             | V <sub>IOD</sub> = 150 mV<br>All other pins grounded                          |
| I <sub>IL</sub>  | Input LOW Current                 |  |                   | -0.6        | mA    | Max             | V <sub>IN</sub> = 0.5V  |
| I <sub>OS</sub>  | Output Short-Circuit Current      |  |                   | -60         | mA    | Max             | V <sub>OUT</sub> = 0V   |
| I <sub>CCH</sub> | Power Supply Current              |  | 12                | 18          | mA    | Max             | V <sub>O</sub> = HIGH   |
| I <sub>CCL</sub> | Power Supply Current              |  | 18                | 28          | mA    | Max             | V <sub>O</sub> = LOW  |

## AC Electrical Characteristics

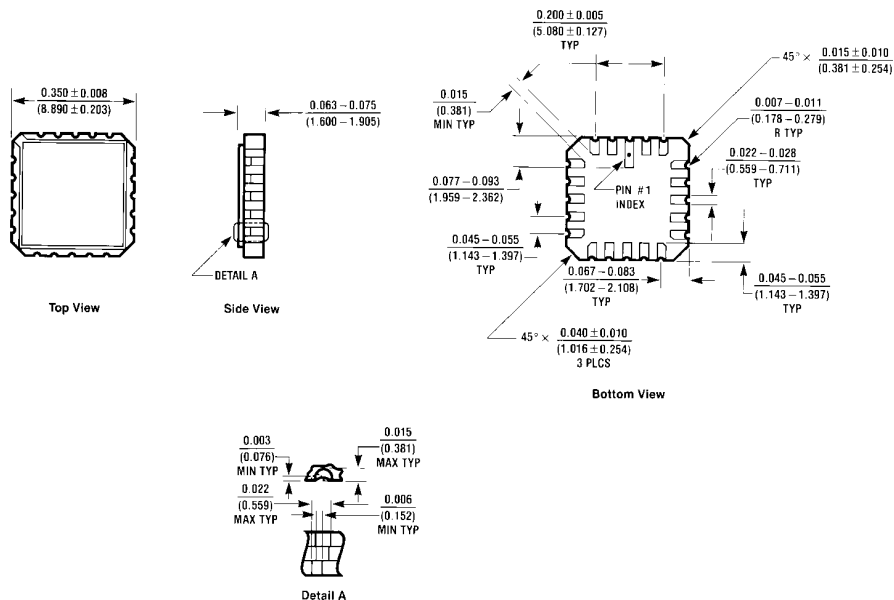
| Symbol                 | Parameter  | 74F  |     |     | 54F  |     | 74F  |     | Units |
|------------------------|--|--|-----|-----|--|-----|--|-----|-------|
|                        |  | $T_A = +25^\circ\text{C}$<br>$V_{CC} = +5.0\text{V}$<br>$C_L = 50\text{ pF}$ |     |     | $T_A, V_{CC} = \text{Mil}$<br>$C_L = 50\text{ pF}$ |     | $T_A, V_{CC} = \text{Com}$<br>$C_L = 50\text{ pF}$ |     |       |
|                        |  | Min  | Typ | Max | Min  | Max | Min  | Max |       |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay<br>$A_n, B_n$ to $O_n$<br>(Other Input LOW)  | 3.0  | 4.0 | 5.5 | 2.5  | 7.0 | 3.0  | 6.5 | ns    |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay<br>$A_n, B_n$ to $O_n$<br>(Other Input HIGH) | 3.5  | 5.3 | 7.0 | 3.5  | 8.5 | 3.5  | 8.0 |       |
|                        |  | 3.0  | 4.2 | 5.5 | 3.0  | 7.0 | 3.0  | 6.5 | ns    |

## 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:



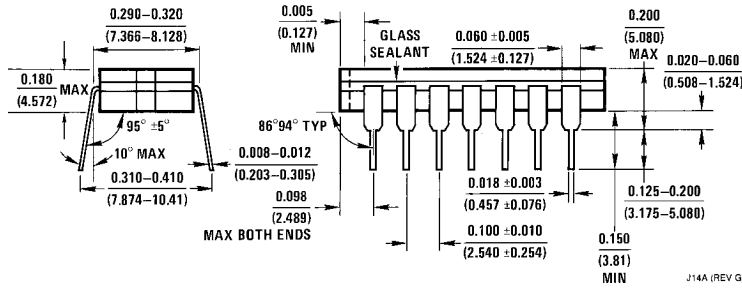
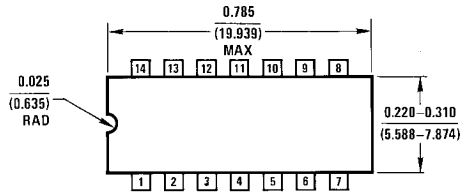
## Physical Dimensions inches (millimeters)



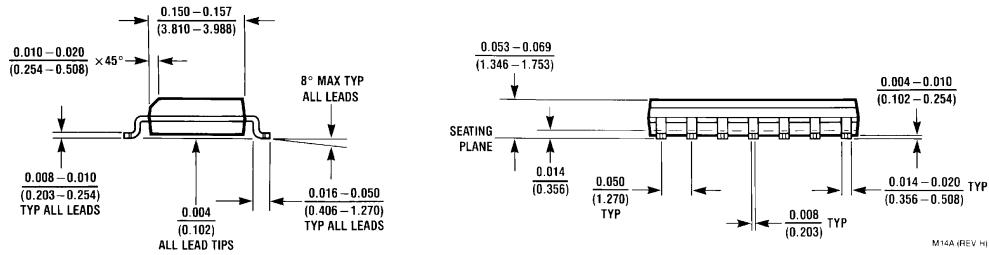
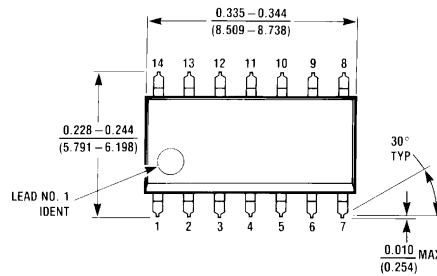
20-Terminal Ceramic Leadless Chip Carrier (L)  
NS Package Number E20A

L27A (REV. 01)

**Physical Dimensions** inches (millimeters) (Continued)

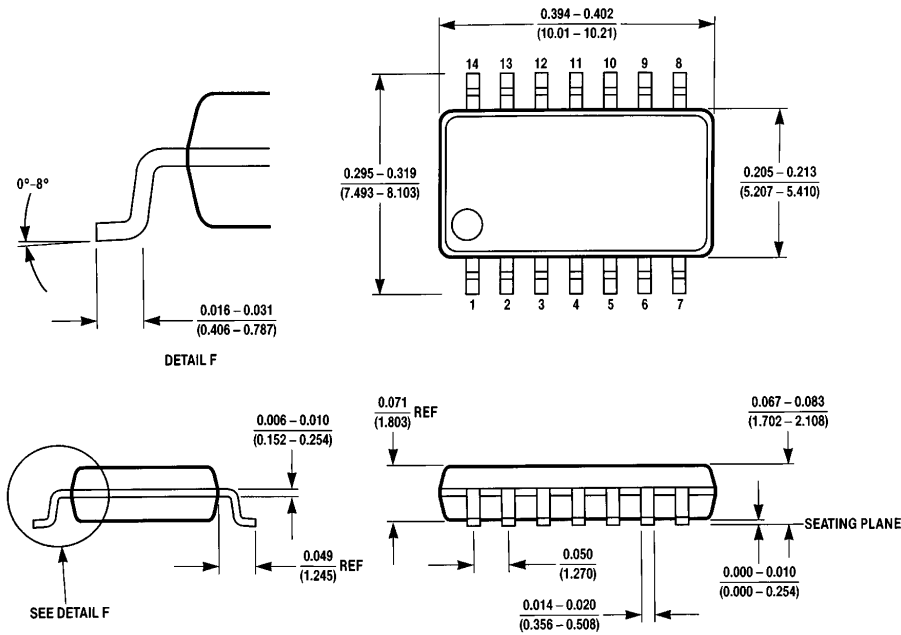


**14-Lead Ceramic Dual-In-Line Package (D)**  
NS Package Number J14A



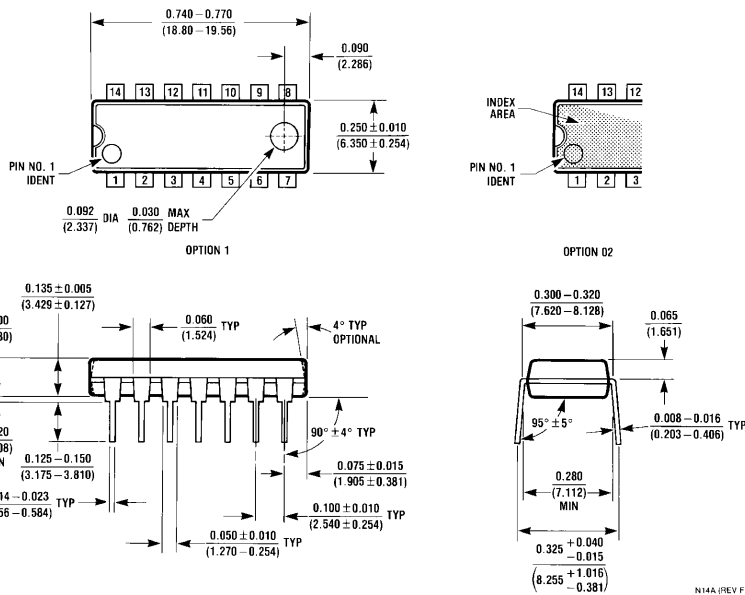
**14-Lead (0.150" Wide) Molded Small Outline Package, JEDEC (S)**  
NS Package Number M14A

**Physical Dimensions** inches (millimeters) (Continued)



M14D (REV A)

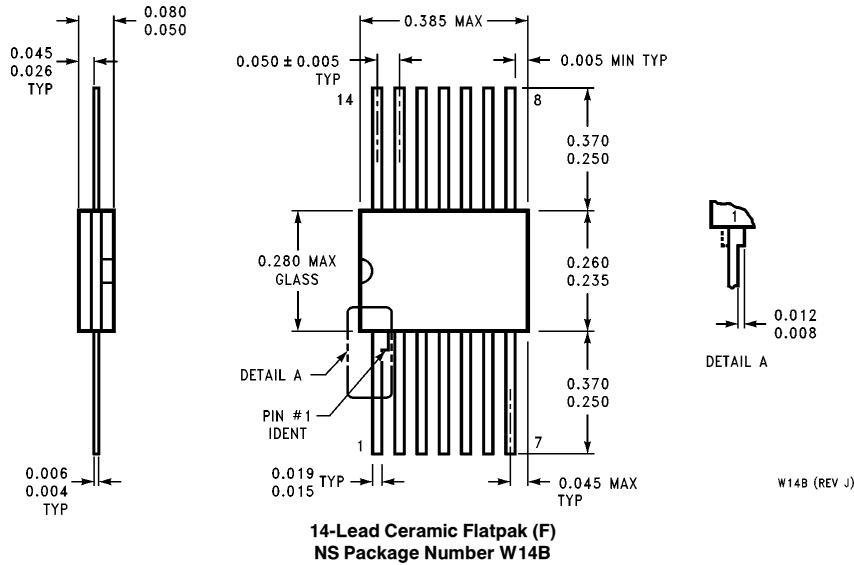
**14-Lead (0.300" Wide) Molded Small Outline Package, EIAJ (SJ)  
NS Package Number M14D**



N14A (REV F)

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

**Physical Dimensions** inches (millimeters) (Continued)



**LIFE SUPPORT POLICY**

NATIONAL'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT OF NATIONAL SEMICONDUCTOR CORPORATION. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform, when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.



**National Semiconductor Corporation**  
2900 Semiconductor Drive  
P.O. Box 58090  
Santa Clara, CA 95052-8090  
Tel: (600) 272-9959  
TWX: (910) 339-9240

**National Semiconductor GmbH**  
Livny-Gargan-Str. 10  
D-82256 Fürstenfeldbruck  
Germany  
Tel: (81-41) 35-0  
Telex: 527849  
Fax: (81-41) 35-1

**National Semiconductor Japan Ltd.**  
Sumitomo Chemical  
Engineering Center  
Bldg. 7F  
1-7-1, Nakase, Mihama-Ku  
Chiba-City,  
Ciba Prefecture 261  
Tel: (043) 299-2300  
Fax: (043) 299-2500

**National Semiconductor Hong Kong Ltd.**  
13th Floor, Straight Block,  
Ocean Centre, 5 Canton Rd.  
Tsimshatsui, Kowloon  
Hong Kong  
Tel: (852) 2737-1600  
Fax: (852) 2736-9960

**National Semicondutores Do Brazil Ltda.**  
Rue Deputado Lacorda Franco  
120-3A  
Sao Paulo-SP  
Brazil 05418-000  
Tel: (55-11) 212-5066  
Telex: 391-1131931 NSBR BR  
Fax: (55-11) 212-1181

**National Semiconductor (Australia) Pty. Ltd.**  
Building 16  
Business Park Drive  
Monash Business Park  
Nottingham, Melbourne  
Victoria 3168 Australia  
Tel: (3) 558-9999  
Fax: (3) 558-9998

National does not assume any responsibility for use of any circuitry described, no circuit patent licenses are implied and National reserves the right at any time without notice to change said circuitry and specifications.