National Semiconductor

September 1996

54AC/74AC00 • 54ACT/74ACT00 Quad 2-Input NAND Gate

General Description

The 'AC/'ACT00 contains four 2-input NAND gates.

Features

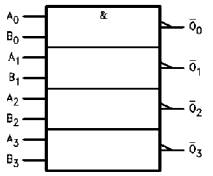
- I_{CC} reduced by 50%
- Outputs source/sink 24 mA
- 'ACT00 has TTL-compatible inputs
- Standard Military Drawing (SMD)
  - — 'AC00: 5962-87549
  - — 'ACT00: 5962-87699

Commercial	Military	Package Number	Package Description
74AC00PC		N14A	14-Lead (0.300″ Wide) Molded Dual-In-Line
	54AC00DM (Note 2)	J14A	14-Lead Ceramic Dual-In-Line
74AC00SC (Note 1)		M14A	14-Lead (0.150″ Wide) Molded Small Outline, JEDEC
74AC00SJ (Note 1)		M14D	14-Lead (0.300″ Wide) Molded Small Outline, EIAJ
74AC00MTC (Note 1)		MTC14	14-Lead Molded Thin Shrink Small Outline, JEDEC
	74AC00FM (Note 2)	W14B	14-Lead Cerpak
	74AC00LM (Note 2)	E20A	20-Lead Ceramic Leadless Chip Carrier, Type C
74ACT00PC		N14A	14-Lead (0.300″ Wide) Molded Dual-In-Line
	54ACT00DM (Note 2)	J14A	14-Lead Ceramic Dual-In-Line
74ACT00SC (Note 1)		M14A	14-Lead (0.150″ Wide) Molded Small Outline, JEDEC
74ACT00SJ (Note 1)		M14D	14-Lead (0.300″ Wide) Molded Small Outline, EIAJ
74ACT00MTC (Note 1)		MTC14	14-Lead Molded Thin Shrink Small Outline, JEDEC
	74ACT00FM (Note 2)	W14B	14-Lead Cerpak
	74ACT00LM (Note 2)	E20A	20-Lead Ceramic Leadless Chip Carrier, Type C

Note 1: Devices also available in 13″ reel. Use suffix = SCX, SJX and MTCX.
Note 2: Military grade device with environmental and burn-in processing. Use suffix = DMQB, FMQB and LMQB.

Logic Symbol

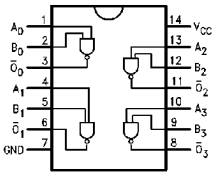
IEEE/IEC



TL/F/9911–1

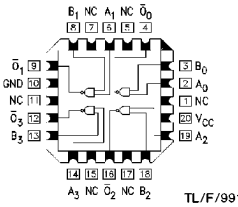
Connection Diagrams

Pin Assignment for DIP, Flatpak, SOIC, and TSSOP



TL/F/9911–3

Pin Assignment for LCC



TL/F/9911–2

Pin Names	Description
A_n, B_n	Inputs
$\overline{O}_n$	Outputs

FACT™ is a 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.

Supply Voltage (V_{CC})	−0.5V to +7.0V
DC Input Diode Current (I_{IK})	
V_I = −0.5V	−20 mA
V_I = V_{CC} + 0.5V	+20 mA
DC Input Voltage (V_I)	−0.5V to V_{CC} + 0.5V
DC Output Diode Current (I_{OK})	
V_O = −0.5V	−20 mA
V_O = V_{CC} + 0.5V	+20 mA
DC Output Voltage (V_O)	−0.5V to V_{CC} + 0.5V
DC Output Source or Sink Current (I_O)	±50 mA
DC V_{CC} or Ground Current per Output Pin (I_{CC} or I_{GND})	±50 mA
Storage Temperature (T_{STG})	−65°C to +150°C
Junction Temperature (T_J)	
CDIP	175°C
PDIP	140°C

Note 1: Absolute maximum ratings are those values beyond which damage to the device may occur. The databook specifications should be met, without exception, to ensure that the system design is reliable over its power supply, temperature, and output/input loading variables. National does not recommend operation of FACT™ circuits outside databook specifications.

Recommended Operating Conditions

Supply Voltage (V_{CC})	
'AC	2.0V to 6.0V
'ACT	4.5V to 5.5V
Input Voltage (V_I)	0V to V_{CC}
Output Voltage (V_O)	0V to V_{CC}
Operating Temperature (T_A)	
74AC/ACT	−40°C to +85°C
54AC/ACT	−55°C to +125°C
Minimum Input Edge Rate ($\Delta V/\Delta t$) 'AC Devices V_{IN} from 30% to 70% of V_{CC} V_{CC} @ 3.3V, 4.5V, 5.5V	125 mV/ns
Minimum Input Edge Rate ($\Delta V/\Delta t$) 'ACT Devices V_{IN} from 0.8V to 2.0V V_{CC} @ 4.5V, 5.5V	125 mV/ns

DC Characteristics for 'AC Family Devices

Symbol	Parameter	V_{CC} (V)	74AC T_A = +25°C	54AC T_A = −55°C to +125°C	74AC T_A = −40°C to +85°C	Units	Conditions
			Typ	Guaranteed Limits			
V_{IH}	Minimum High Level Input Voltage	3.0	1.5	2.1	2.1	V	V_{OUT} = 0.1V or V_{CC} − 0.1V
		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} = 0.1V or V_{CC} − 0.1V
		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	2.4	V	*V_{IN} = V_{IL} or V_{IH} I_{OH} −12 mA
		4.5		3.86	3.7		I_{OH} −24 mA
		5.5		4.86	4.7		I_{OH} −24 mA
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	0.5	V	*V_{IN} = V_{IL} or V_{IH} I_{OL} 12 mA
		4.5		0.36	0.5		I_{OL} 24 mA
		5.5		0.36	0.5		I_{OL} 24 mA
I_{IN}	Maximum Input Leakage Current	5.5		±0.1	±1.0	μA	V_I = V_{CC}, GND

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

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

I_{CC} for 54AC @ 25°C is identical to 74AC @ 25°C.

DC Characteristics for 'AC Family Devices (Continued)

Symbol	Parameter	V_{CC} (V)	74AC $T_A = +25°C$		54AC $T_A = -55°C$ to $+125°C$	74AC $T_A = -40°C$ to $+85°C$	Units	Conditions
			Typ	Guaranteed Limits				
I_{OLD}	†Minimum Dynamic Output Current	5.5			50	75	mA	V_{OLD} = 1.65V Max
I_{OHD}		5.5			−50	−75	mA	V_{OHD} = 3.85V Min
I_{CC}	Maximum Quiescent Supply Current	5.5		2.0	40.0	20.0	μA	$V_{IN} = V_{CC}$ or GND

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

Note: I_{IN} and I_{CC} @ 3.0V are guaranteed to be less than or equal to the respective limit @ 5.5V V_{CC}.
I_{CC} for 54AC @ 25°C is identical to 74AC @ 25°C.

DC Characteristics for 'ACT Family Devices

Symbol	Parameter	V_{CC} (V)	74ACT $T_A = +25°C$		54ACT $T_A = -55°C$ to $+125°C$	74ACT $T_A = -40°C$ to $+85°C$	Units	Conditions
			Typ	Guaranteed Limits				
V_{IH}	Minimum High Level Input Voltage	4.5 5.5	1.5 1.5	2.0 2.0	2.0 2.0	2.0 2.0	V	V_{OUT} = 0.1V or V_{CC} − 0.1V
V_{IL}	Maximum Low Level Input Voltage	4.5 5.5	1.5 1.5	0.8 0.8	0.8 0.8	0.8 0.8	V	V_{OUT} = 0.1V or V_{CC} − 0.1V
V_{OH}	Minimum High Level Output Voltage	4.5 5.5	4.49 5.49	4.4 5.4	4.4 5.4	4.4 5.4	V	I_{OUT} = −50 μA
		4.5 5.5		3.86 4.86	3.70 4.70	3.76 4.76	V	*V_{IN} = V_{IL} or V_{IH} I_{OH} −24 mA I_{OH} −24 mA
V_{OL}	Maximum Low Level Output Voltage	4.5 5.5	0.001 0.001	0.1 0.1	0.1 0.1	0.1 0.1	V	I_{OUT} = 50 μA
		4.5 5.5		0.36 0.36	0.50 0.50	0.44 0.44	V	*V_{IN} = V_{IL} or V_{IH} I_{OL} 24 mA I_{OL} 24 mA
I_{IN}	Maximum Input Leakage Current	5.5		±0.1	±1.0	±1.0	μA	$V_I = V_{CC}$, GND
I_{CCT}	Maximum I_{CC}/Input	5.5	0.6		1.6	1.5	mA	$V_I = V_{CC}$ − 2.1V
I_{OLD}	†Minimum Dynamic Output Current	5.5			50	75	mA	V_{OLD} = 1.65V Max
I_{OHD}		5.5			−50	−75	mA	V_{OHD} = 3.85V Min
I_{CC}	Maximum Quiescent Supply Current	5.5		2.0	40.0	20.0	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_{CC} for 54ACT @ 25°C is identical to 74ACT @ 25°C.

AC Electrical Characteristics

Symbol	Parameter	V_{CC}* (V)	74AC $T_A = +25°C$, $C_L = 50$ pF			54AC $T_A = -55°C$ to $+125°C$, $C_L = 50$ pF		74AC $T_A = -40°C$ to $+85°C$, $C_L = 50$ pF		Units
			Min	Typ	Max	Min	Max	Min	Max	
t_{PLH}	Propagation Delay	3.3	2.0	7.0	9.5	1.0	11.0	2.0	10.0	ns
		5.0	1.5	6.0	8.0	1.5	8.5	1.5	8.5	
t_{PHL}	Propagation Delay	3.3	1.5	5.5	8.0	1.0	9.0	1.0	8.5	ns
		5.0	1.5	4.5	6.5	1.5	7.0	1.0	7.0	

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

AC Electrical Characteristics

Symbol	Parameter	V_{CC}* (V)	74ACT $T_A = +25°C$, $C_L = 50$ pF			54ACT $T_A = -55°C$ to $+125°C$, $C_L = 50$ pF		74ACT $T_A = -40°C$ to $+85°C$, $C_L = 50$ pF		Units
			Min	Typ	Max	Min	Max	Min	Max	
t_{PLH}	Propagation Delay	5.0	1.5	5.5	9.0	1.5	9.5	1.0	9.5	ns
t_{PHL}	Propagation Delay	5.0	1.5	4.0	7.0	1.5	8.0	1.0	8.0	ns

Voltage Range 5.0 is 5.0V ±0.5V

Capacitance

Symbol	Parameter	Typ	Units	Conditions
C_{IN}	Input Capacitance	4.5	pF	V_{CC} = Open
C_{PD}	Power Dissipation Capacitance	30.0	pF	V_{CC} = 5.0V

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:

74ACT 00 P C QR

Temperature Range Family
- 74AC = Commercial
- 54AC = Military
- 74ACT = Commercial TTL-Compatible
- 54ACT = Military TTL-Compatible

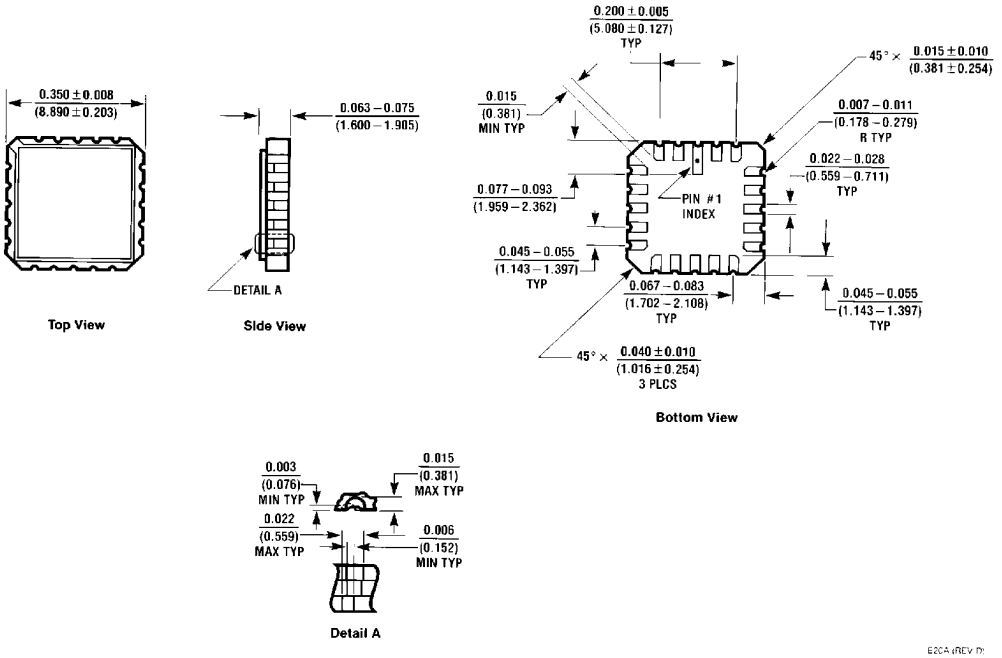
Device Type

Package Code
- P = Plastic DIP
- D = Ceramic DIP
- F = Flatpak
- L = Leadless Ceramic Chip Carrier (LCC)
- S = Small Outline (SOIC)
- MTC = Molded Thin Shrink Small Outline Package (14 thru 24 Lead)

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

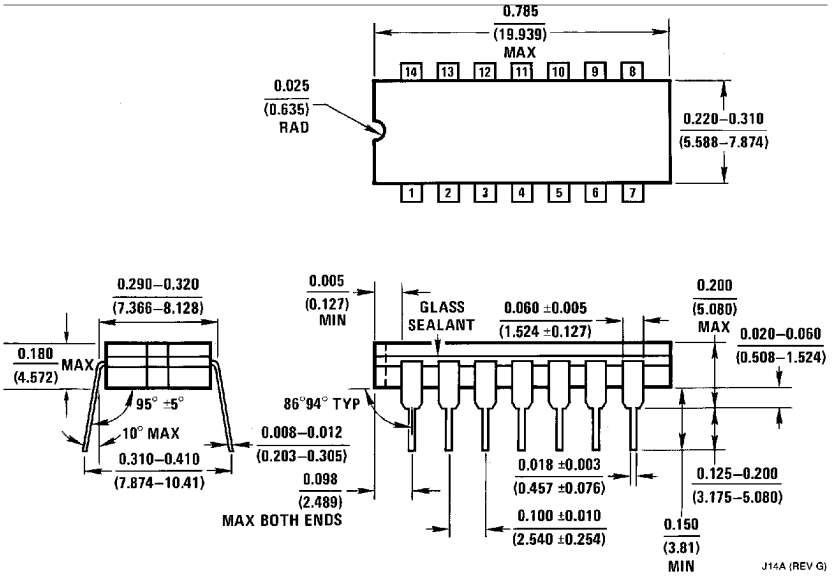
Temperature Range
- C = Commercial (−40°C to +85°C)
- M = Military (−55°C to +125°C)

Physical Dimensions inches (millimeters) unless otherwise noted

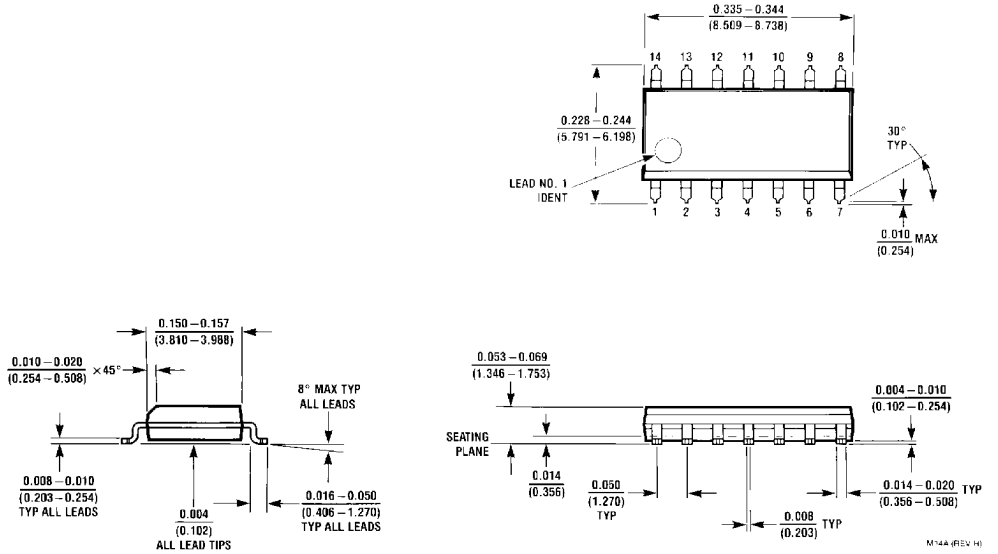


20 Terminal Ceramic Leadless Chip Carrier (L)
NS Package Number E20A

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)

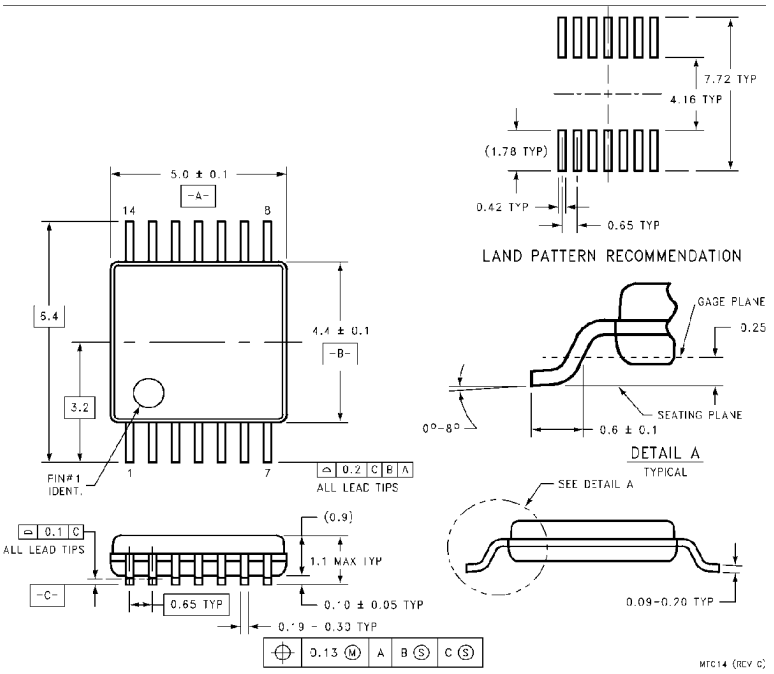


14 Lead Ceramic Dual-In-Line Package (D)
NS Package Number J14A

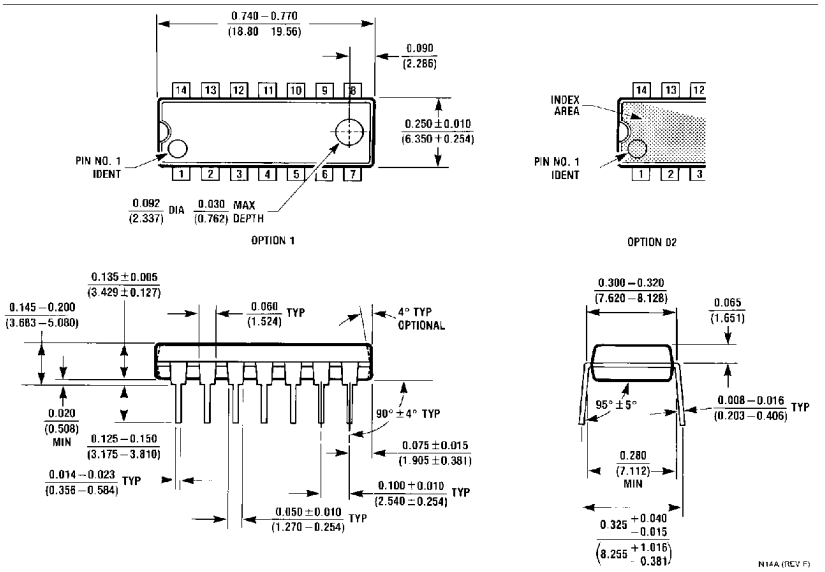


14 Lead Small Outline Integrated Circuit (S)
NS Package Number M14A

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)

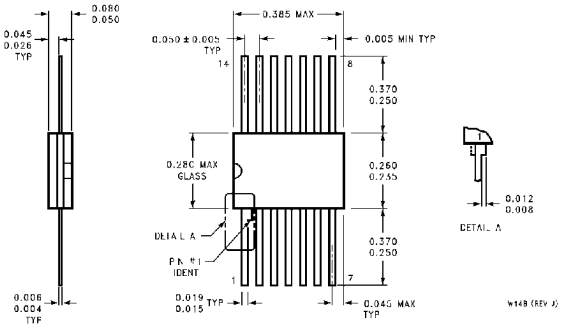


14 Lead Molded Thin Shrink Small Outline Package, JEDEC
NS Package Number MTC14



14 Lead Plastic Dual-In-Line Package (P)
NS Package Number N14A

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



14 Lead Ceramic Flatpak (F)
NS Package Number W14B

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
1111 West Bardin Road
Arlington, TX 76017
Tel: 1(800) 272-9959
Fax: 1(800) 737-7018

http://www.national.com

National Semiconductor Europe
Fax: +49 (0) 180-530 85 86
Email: europe.support@nsc.com
Deutsch Tel: +49 (0) 180-530 85 85
English Tel: +49 (0) 180-532 78 32
Français Tel: +49 (0) 180-532 93 58
Italiano Tel: +49 (0) 180-534 16 80

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 Semiconductor Japan Ltd.
Tel: 81-043-299-2308
Fax: 81-043-299-2408