

# 93L24 5-Bit Comparator

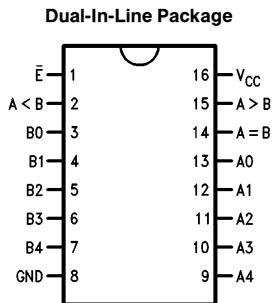
## General Description

The 93L24 expandable comparator provides comparison between two 5-bit words and gives three outputs—"less than", "greater than" and "equal to". A HIGH on the active LOW Enable Input forces all three outputs LOW.

## Features

- Three separate outputs: A < B, A > B, A = B
- Easily expandable
- Active low enable input

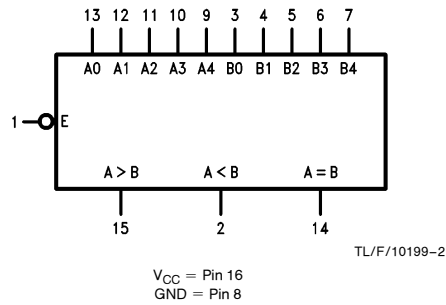
## Connection Diagram



TL/F/10199-1

**Order Number 93L24DMQB or 93L24FMQB**  
See NS Package Number J16A or W16A

## Logic Symbol



## Truth Table

Pin Names	Description
$\bar{E}$	Enable Input (Active LOW)
A0–A4	Word A Parallel Inputs
B0–B4	Word B Parallel Inputs
A < B	A Less than B Output (Active HIGH)
A > B	A Greater than B Output (Active HIGH)
A = B	A Equal to B Output (Active HIGH)

Inputs			Outputs		
$\bar{E}$	A <sub>n</sub>	B <sub>n</sub>	A < B	A > B	A = B
H	X	X	L	L	L
L	Word A = Word B		L	L	H
L	Word A > Word B		L	H	L
L	Word B < Word A		H	L	L

H = HIGH Voltage Level  
L = LOW Voltage Level  
X = Immaterial

## Absolute Maximum Ratings (Note)

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

Supply Voltage	7V
Input Voltage	5.5V
Operating Free Air Temperature Range	
MIL	−55°C to +125°C
Storage Temperature Range	−65°C to +150°C

Note: The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the "Electrical Characteristics" table are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

## Recommended Operating Conditions

Symbol	Parameter	93L24 (MIL)			Units
		Min	Nom	Max	
V <sub>CC</sub>	Supply Voltage	4.5	5	5.5	V
V <sub>IH</sub>	High Level Input Voltage	2			V
V <sub>IL</sub>	Low Level Input Voltage			0.7	V
I <sub>OH</sub>	High Level Output Current			−400	μA
I <sub>OL</sub>	Low Level Output Current			4.8	mA
T <sub>A</sub>	Free Air Operating Temperature	−55		125	°C

## Electrical Characteristics over recommended operating free air temperature (unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ (Note 1)	Max	Units
V <sub>I</sub>	Input Clamp Voltage	V <sub>CC</sub> = Min, I <sub>I</sub> = −10 mA			−1.5	V
V <sub>OH</sub>	High Level Output Voltage	V <sub>CC</sub> = Min, I <sub>OH</sub> = Max, V <sub>IL</sub> = Max, V <sub>IH</sub> = Min	2.4			V
V <sub>OL</sub>	Low Level Output Voltage	V <sub>CC</sub> = Min, I <sub>OL</sub> = Max, V <sub>IH</sub> = Min, V <sub>IL</sub> = Max			0.3	V
I <sub>I</sub>	Input Current @ Max Input Voltage	V <sub>CC</sub> = Max, V <sub>I</sub> = 5.5V			1	mA
I <sub>IH</sub>	High Level Input Current	V <sub>CC</sub> = Max, V <sub>I</sub> = 2.4V			40	μA
I <sub>IL</sub>	Low Level Input Current	V <sub>CC</sub> = Max, V <sub>I</sub> = 0.3V			−0.8	mA
I <sub>OS</sub>	Short Circuit Output Current	V <sub>CC</sub> = Max (Note 2)	−2.5		−25	mA
I <sub>CC</sub>	Supply Current	V <sub>CC</sub> = Max			21	mA

Note 1: All typicals are at V<sub>CC</sub> = 5V, T<sub>A</sub> = 25°C.

Note 2: Not more than one output should be shorted at a time, and the duration should not exceed one second.

## Switching Characteristics

$V_{CC} = +5.0V$ ,  $T_A = +25^\circ C$  (See Section 1 for test waveforms and output load)

Symbol	Parameter	$C_L = 15 \text{ pF}$		Units
		Min	Max	
$t_{PLH}$ $t_{PHL}$	Propagation Delay $\bar{E}$ to $A=B$ ; $\bar{E}$ to $A<B$ , $A>B$		32 35	ns
$t_{PLH}$ $t_{PHL}$	Propagation Delay $A_n$ to $A>B$ ; $B_n$ to $A>B$		54 75	ns
$t_{PLH}$ $t_{PHL}$	Propagation Delay $A_n$ to $A<B$ ; $B_n$ to $A<B$		70 77	ns
$t_{PLH}$ $t_{PHL}$	Propagation Delay $A_n$ or $B_n$ to $A=B$		100 102	ns

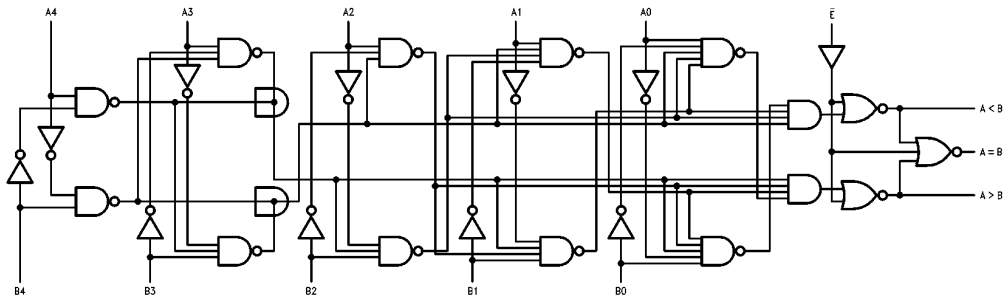
## Functional Description

The 93L24 5-bit comparators use combinational circuitry to directly generate "A greater than B" and "A less than B" outputs. As evident from the logic diagram, these outputs are generated in only three gate delays. The "A equals B" output is generated in one additional gate delay by decoding the "A neither less than nor greater than B" condition with a NOR gate. All three outputs are activated by the active LOW Enable Input ( $\bar{E}$ ).

Tying the  $A>B$  output from one device into an  $A$  input on another device and the  $A<B$  output into the corresponding  $B$  input permits easy expansion.

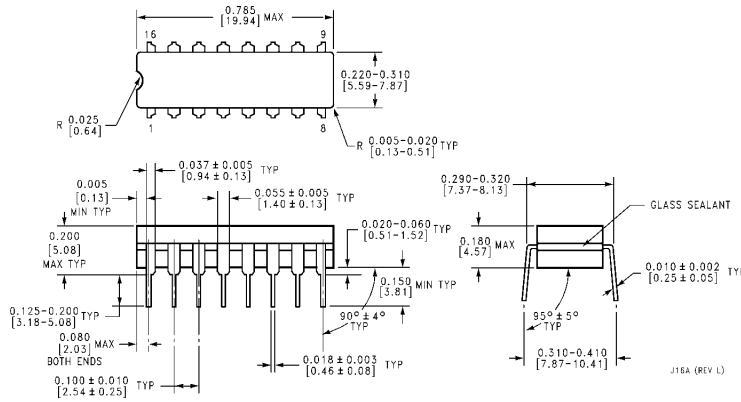
The  $A_4$  and  $B_4$  inputs are the most significant inputs and  $A_0$ ,  $B_0$  the least significant. Thus if  $A_4$  is HIGH and  $B_4$  is LOW, the  $A>B$  output will be HIGH regardless of all other inputs except  $\bar{E}$ .

## Logic Diagram

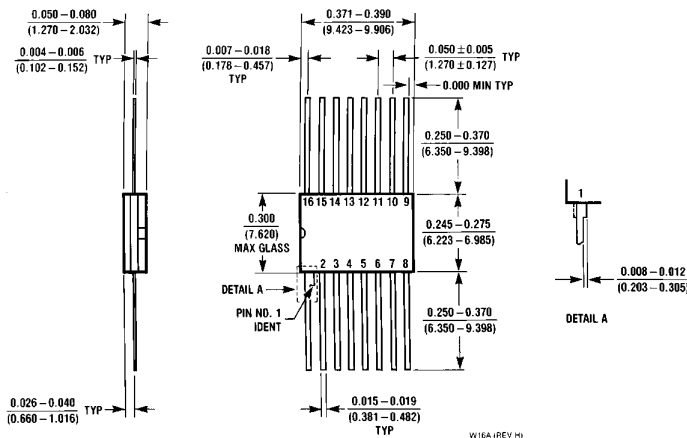


TL/F/10199-3

**Physical Dimensions** inches (millimeters)



**16-Lead Ceramic Dual-In-Line Package (J)**  
**Order Number 93L24DMQB**  
**NS Package Number J16A**




**16-Lead Ceramic Flat Package (W)**  
**Order Number 93L24FMQB**  
**NS Package Number W16A**

**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.

 <p><b>National Semiconductor Corporation</b>          1111 West Bardin Road          Arlington, TX 76017          Tel: 1(800) 272-9959          Fax: 1(800) 737-7018</p>	<p><b>National Semiconductor Europe</b>          Fax: (+49) 0-180-530 85 86          Email: onjwge@tevm2.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</p>	<p><b>National Semiconductor Hong Kong Ltd.</b>          19th Floor, Straight Block,          Ocean Centre, 5 Canton Rd.          Tsimshatsui, Kowloon          Hong Kong          Tel: (852) 2737-1600          Fax: (852) 2736-9960</p>	<p><b>National Semiconductor Japan Ltd.</b>          Tel: 81-043-299-2309          Fax: 81-043-299-2408</p>
--	--	---	---

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.