National Semiconductor

August 1993

54LVQ/74LVQ125
Low Voltage Quad Buffer with TRI-STATE® Outputs

General Description

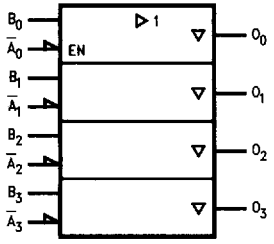
The 'LVQ125 contains four independent non-inverting buffers with TRI-STATE outputs.

Features

- Ideal for low power/low noise 3.3V applications
- Guaranteed simultaneous switching noise level and dynamic threshold performance
- Guaranteed pin-to-pin skew AC performance
- Guaranteed incident wave switching into 75Ω

Logic Symbol

IEEE/IEC



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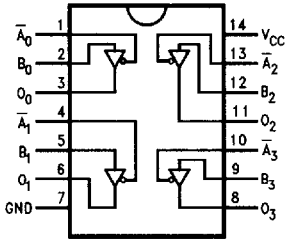
Connection Diagrams

Pin Assignment for for DIP, SOIC and Flatpak



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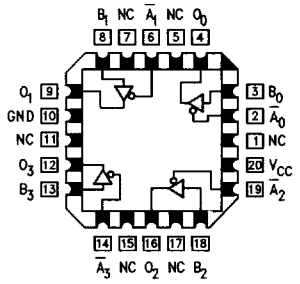
Pin Assignment for LCC



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Pin Names	Description
$\overline{A}_n$, B_n	Inputs
O_n	Outputs

Function Table

Inputs		Output
A_n	B_n	O_n
L	L	L
L	H	H
H	X	Z

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

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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.

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
DC Latch-Up Source or Sink Current	±100 mA
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 'LVQ circuits outside databook specifications.

Recommended Operating Conditions

Supply Voltage (V_{CC})	
'LVQ	3.0V to 3.6V
Input Voltage (V_I)	0V to V_{CC}
Output Voltage (V_O)	0V to V_{CC}
Operating Temperature (T_A)	
74LVQ	−40°C to +85°C
54LVQ	−55°C to +125°C
Minimum Input Edge Rate ($\Delta V/\Delta t$)	
V_{IN} from 0.8V to 2.0V	
V_{CC} @ 3.0V	125 mV/ns

DC Characteristics

Symbol	Parameter	V_{CC} (V)	74LVQ T_A = +25°C		54LVQ T_A = −55°C to +125°C	74LVQ T_A = −40°C to +85°C	Units	Conditions
			Typ	Guaranteed Limits				
V_{IH}	Minimum High Level Input Voltage	3.0	1.5	2.0	2.0	2.0	V	V_{OUT} = 0.1V or V_{CC} − 0.1V
V_{IL}	Maximum Low Level Input Voltage	3.0	1.5	0.8	0.8	0.8	V	V_{OUT} = 0.1V or V_{CC} − 0.1V
V_{OH}	Minimum High Level Output Voltage	3.0	2.99	2.9	2.9	2.9	V	I_{OUT} = −50 μA
		3.0		2.56	2.4	2.46		*V_{IN} = V_{IL} or V_{IH} I_{OH} = −12 mA
V_{OL}	Maximum Low Level Output Voltage	3.0	0.002	0.1	0.1	0.1	V	I_{OUT} = 50 μA
		3.0		0.36	0.50	0.44	V	*V_{IN} = V_{IL} or V_{IH} I_{OL} = 12 mA
I_{IN}	Maximum Input Leakage Current	3.6		±0.1	±1.0	±1.0	μA	V_I = V_{CC}, GND
I_{OZ}	Maximum TRI-STATE Leakage Current	3.6		±0.5	±10.0	±5.0	μA	V_I (OE) = V_{IL}, V_{IH} V_I = V_{CC}, V_{GND} V_O = V_{CC}, GND

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

DC Characteristics (Continued)

Symbol	Parameter	V_{CC} (V)	74LVQ $T_A = +25°C$		54LVQ $T_A = -55°C$ to $+125°C$	74LVQ $T_A = -40°C$ to $+85°C$	Units	Conditions
			Typ	Guaranteed Limits				
I_{OLD}	†Minimum Dynamic Output Current	3.6				36	mA	V_{OLD} = 0.8V Max (Note 1)
I_{OHD}		3.6				−25	mA	V_{OHD} = 2.0V Min (Note 1)
I_{CC}	Maximum Quiescent Supply Current	3.6		5.0	100	50	μA	$V_{IN} = V_{CC}$ or GND
V_{OLP}	Quiet Output Maximum Dynamic V_{OL}	3.3	0.6	1.0			V	(Notes 2 and 3)
V_{OLV}	Quiet Output Minimum Dynamic V_{OL}	3.3	−0.6	−1.0			V	(Notes 2 and 3)
V_{IHD}	Maximum High Level Dynamic Input Voltage	3.3	1.7	2.0			V	(Notes 2 and 4)
V_{ILD}	Maximum Low Level Dynamic Input Voltage	3.3	1.5	0.8			V	(Notes 2 and 4)

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

Note 1: Incident wave switching on transmission lines with impedances as low as 75Ω for commercial temperature range is guaranteed for 74LVQ.

Note 2: Worst case package.

Note 3: Max number of outputs defined as (n). Data inputs are driven 0V to 3.3V; one output at GND.

Note 4: Max number of Data Inputs (n) switching. (n − 1) inputs switching 0V to 3.3V. Input-under-test switching: 3.3V to threshold (V_{ILD}), 0V to threshold (V_{IHD}), f = 1 MHz.

AC Electrical Characteristics

Symbol	Parameter	V_{CC}* (V)	74LVQ $T_A = +25°C$, $C_L = 50$ pF			54LVQ $T_A = -55°C$ to $+125°C$, $C_L = 50$ pF		74LVQ $T_A = -40°C$ to $+85°C$, $C_L = 50$ pF		Units
			Min	Typ	Max	Min	Max	Min	Max	
t_{PLH}	Propagation Delay Data to Output	3.3	1.0	6.5	9.0			1.0	10.0	ns
t_{PHL}	Propagation Delay Data to Output	3.3	1.0	6.5	9.0			1.0	10.0	ns
t_{PZH}	Output Enable Time	3.3	1.0	6.0	10.5			1.0	11.0	ns
t_{PZL}	Output Enable Time	3.3	1.0	7.5	10.0			1.0	11.0	ns
t_{PHZ}	Output Disable Time	3.3	1.0	7.5	10.0			1.0	10.5	ns
t_{PLZ}	Output Disable Time	3.3	1.0	7.5	10.5			1.0	11.5	ns
t_{OSHL}, t_{OSLH}	Output to Output Skew** Data to Output	3.3		1.0	1.5				1.5	ns

*Voltage range is 3.3V ±0.3V.

**Skew is defined as the absolute value of the difference between the actual propagation delay for any two separate outputs of the same device. The specification applies to any outputs switching in the same direction, either HIGH to LOW (t_{OSHL}) or LOW to HIGH (t_{OSLH}). Parameter guaranteed by design.

Capacitance

Symbol	Parameter	Typ	Units	Conditions
C_{IN}	Input Capacitance	4.5	pF	V_{CC} = 3.3V
C_{PD} (Note 1)	Power Dissipation Capacitance	34	pF	V_{CC} = 3.3V

Note 1: C_{PD} is measured at 10 MHz.

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:

74LVQ 125 S C X

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

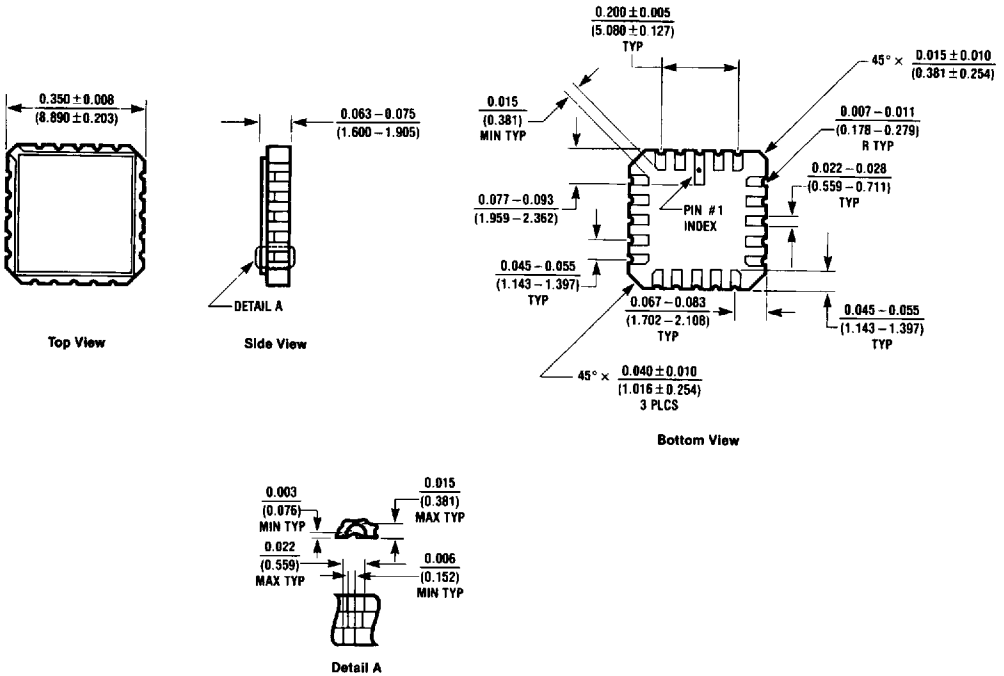
Device Type

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

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

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

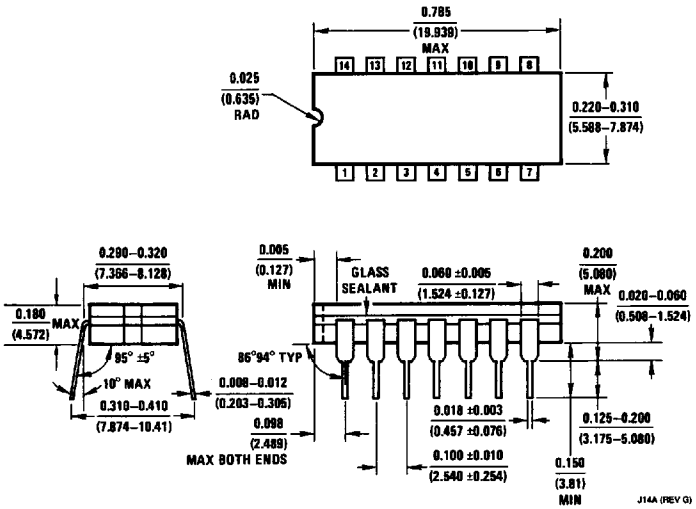
Physical Dimensions inches (millimeters)



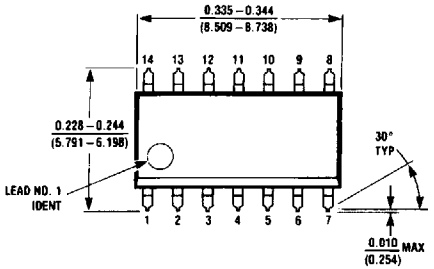
E20A (REV D)

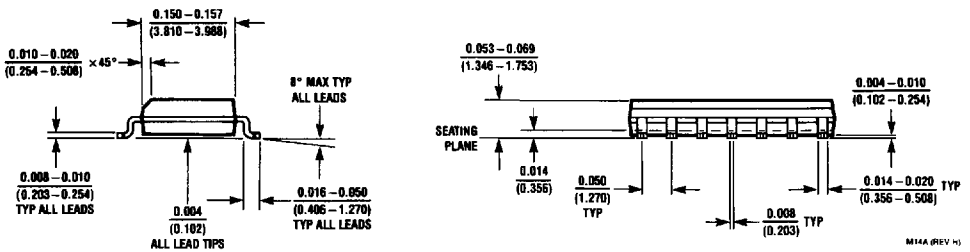
20 Terminal Ceramic Leadless Chip Carrier (L)
NS Package Number E20A

Physical Dimensions inches (millimeters) (Continued)



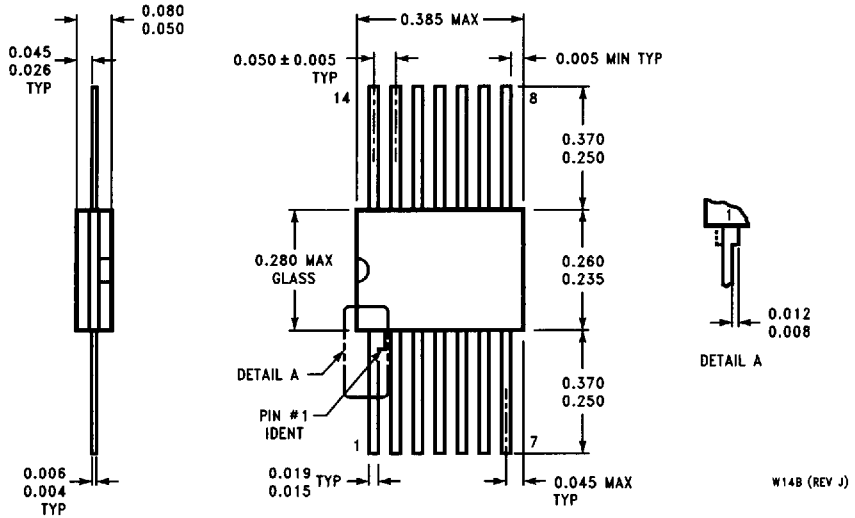
14-Lead Ceramic Dual-In-Line Package (D)
NS Package Number J14A





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

Physical Dimensions inches (millimeters) (Continued)



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

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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.

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