National Semiconductor

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93L09
Dual 4-Input Multiplexer

General Description

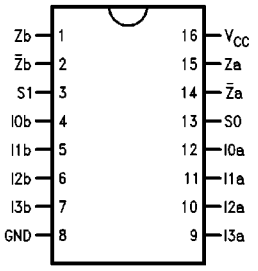
The 93L09 monolithic dual 4-input digital multiplexers consist of two multiplexing circuits with common input select logic. Each circuit contains four inputs and fully buffered complementary outputs. In addition to multiplexer operation, the 93L09 can generate any two functions of three variables. Active pullups in the outputs ensure high drive and high speed performance. Because of its high speed performance and on-chip select decoding, the 93L09 may be cascaded to multiple levels so that any number of lines can be multiplexed onto a single output bus.

Features

- Multifunction capability
- On-chip select logic decoding
- Fully buffered complementary outputs

Connection Diagram

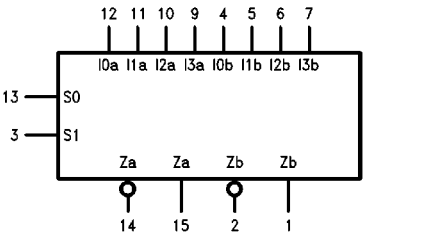
Dual-In-Line Package



TL/F/9602–1

Order Number 93L09DMQB or 93L09FMQB
See NS Package Number J16A or W16A

Logic Symbol



TL/F/9602–2

V_{CC} = Pin 16
GND = Pin 8

Pin Names	Description
S0, S1	Common Select Inputs
I0a–I3a	Multiplexer A Inputs
Za	Multiplexer A Output
$\overline{Z}$a	Complementary Multiplexer A Output
I0b–I3b	Multiplexer B Inputs
Zb	Multiplexer B Output
$\overline{Z}$b	Complementary Multiplexer B Output

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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	93L09 (MIL)			Units
		Min	Nom	Max	
V_{CC}	Supply Voltage	4.5	5	5.5	V
V_{IH}	High Level Input Voltage	2			V
V_{IL}	Low Level Input Voltage			0.7	V
I_{OH}	High Level Output Current			−400	μA
I_{OL}	Low Level Output Current			4.8	mA
T_A	Free Air Operating Temperature	−55		125	°C

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

Symbol	Parameter	Conditions	Min	Typ (Note 1)	Max	Units
V_I	Input Clamp Voltage	V_{CC} = Min, II = −10 mA			−1.5	V
V_{OH}	High Level Output Voltage	V_{CC} = Min, I_{OH} = Max, V_{IL} = Max, V_{IH} = Min	2.4			V
V_{OL}	Low Level Output Voltage	V_{CC} = Min, I_{OL} = Max, V_{IH} = Min, V_{IL} = Max			0.3	V
II	Input Current @ Max Input Voltage	V_{CC} = Max, V_I = 5.5V			1	mA
IIH	High Level Input Current	V_{CC} = Max, V_I = 2.4V			20	μA
I_{IL}	Low Level Input Current	V_{CC} = Max, V_I = 0.3V			−400	μA
I_{OS}	Short Circuit Output Current	V_{CC} = Max (Note 2)	−10		−40	mA
I_{CC}	Supply Current	V_{CC} = Max			11.5	mA

Note 1: All typicals are at V_{CC} = 5V, T_A = 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 $V_{CC} = +5.0V, T_A = +25°C$

Symbol	Parameter	$C_L = 15$ pF		Units
		Min	Max	
t_{PLH} t_{PHL}	Propagation Delay S_0 to Z_a		70 60	ns
t_{PLH} t_{PHL}	Propagation Delay S_0 to $\overline{Z}_a$		55 50	ns
t_{PLH} t_{PHL}	Propagation Delay I_0 to Z_a		70 65	ns
t_{PLH} t_{PHL}	Propagation Delay S_0 to $\overline{Z}_a$		40 60	ns

Functional Description

The 93L09 dual 4-input multiplexers are able to select two bits of either HIGH or LOW data or control from up to four sources, in one package. The 93L09 is the logical implementation of two-pole, four-position switch, with the position of the switch being set by the logic levels supplied to the two select inputs. Both assertion and negation outputs are provided for both multiplexers. The logic equations for the outputs are shown below:

$$Za = I0a \bullet \overline{S1} \bullet \overline{S0} + I1a \bullet \overline{S1} \bullet S0 + I2a \bullet S1 \bullet \overline{S0} + I3a \bullet S1 \bullet S0$$

$$Zb = I0b \bullet \overline{S1} \bullet \overline{S0} + I1b \bullet \overline{S1} \bullet S0 + I2a \bullet S1 \bullet \overline{S0} + I3b \bullet S1 \bullet S0$$

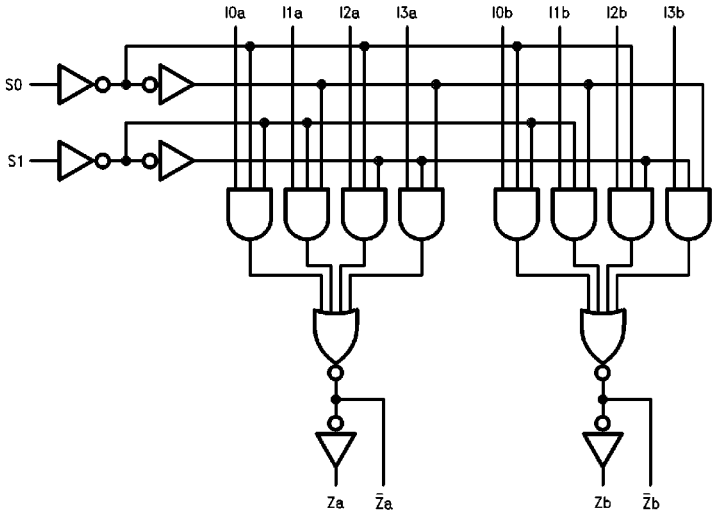
The 93L09 is frequently used to move data from a group of registers to a common output bus. The particular register from which the data came would be determined by the state of the select inputs. A less obvious application is as a function generator. The 93L09 can generate two functions of three variables. This is useful for implementing random gating functions.

Truth Table

Select Inputs		Inputs (a or b)				Outputs (a or b)	
S0	S1	I0	I1	I2	I3	Z	$\overline{Z}$
L	L	L	X	X	X	L	H
L	L	H	X	X	X	H	L
H	L	X	L	X	X	L	H
H	L	X	H	X	X	H	L
L	H	X	X	L	X	L	H
L	H	X	X	H	X	H	L
H	H	X	X	X	L	L	H
H	H	X	X	X	H	H	L

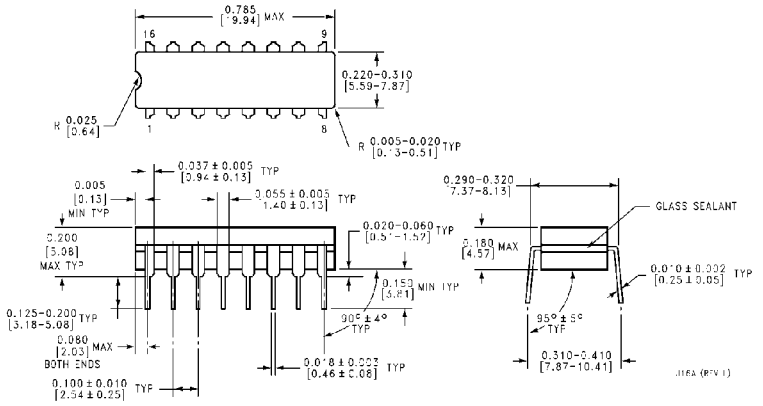
H = HIGH voltage level
L = LOW voltage level
X = Immaterial

Logic Diagram

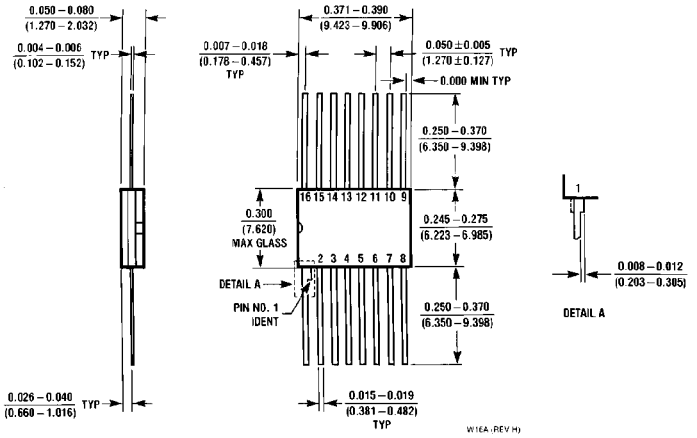


TL/F/9602–3

Physical Dimensions inches (millimeters)



16-Lead Ceramic Dual-In-Line Package (J)
Order Number 93L09DMQB
NS Package Number J16A



16-Lead Ceramic Flat Package (W)
Order Number 93L09FMQB
NS Package Number W16A

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