

## 93L09 Dual 4-Input Multiplexer

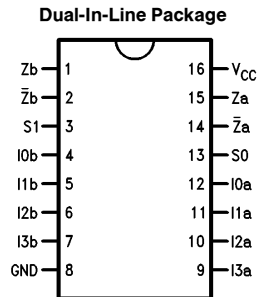
### General Description

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

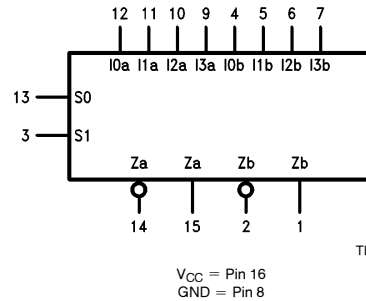
- Multifunction capability
- On-chip select logic decoding
- Fully buffered complementary outputs

### Connection Diagram



TL/F/9602-1

### Logic Symbol



TL/F/9602-2

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

Pin Names	Description
S0, S1	Common Select Inputs
I0a-I3a	Multiplexer A Inputs
Za	Multiplexer A Output
Za-bar	Complementary Multiplexer A Output
I0b-I3b	Multiplexer B Inputs
Zb	Multiplexer B Output
Zb-bar	Complementary Multiplexer B Output

## 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 <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 range (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			20	μA
I <sub>IL</sub>	Low Level Input Current	V <sub>CC</sub> = Max, V <sub>I</sub> = 0.3V			−400	μA
I <sub>OS</sub>	Short Circuit Output Current	V <sub>CC</sub> = Max (Note 2)	−10		−40	mA
I <sub>CC</sub>	Supply Current	V <sub>CC</sub> = Max			11.5	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 $V_{CC} = +5.0V, T_A = +25^\circ C$

Symbol	Parameter	$C_L = 15\text{ pF}$		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 $\bar{Z}_a$		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 $\bar{Z}_a$		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:

$$Z_a = I_{0a} \cdot \bar{S}_1 \cdot \bar{S}_0 + I_{1a} \cdot \bar{S}_1 \cdot S_0 + I_{2a} \cdot S_1 \cdot \bar{S}_0 + I_{3a} \cdot S_1 \cdot S_0$$

$$Z_b = I_{0b} \cdot \bar{S}_1 \cdot \bar{S}_0 + I_{1b} \cdot \bar{S}_1 \cdot S_0 + I_{2b} \cdot S_1 \cdot \bar{S}_0 + I_{3b} \cdot S_1 \cdot S_0$$

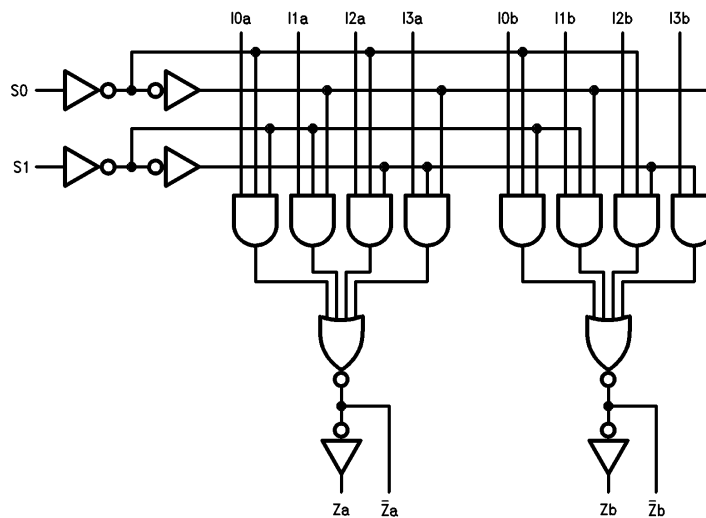
The 93L09 is frequently used to move data from a group of registers to a common output bus. The particular register from which the data came would be determined by the state of the select inputs. A less obvious application is as a function generator. The 93L09 can generate two functions of three variables.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

## Truth Table

Select Inputs		Inputs (a or b)				Outputs (a or b)	
$S_0$	$S_1$	$I_0$	$I_1$	$I_2$	$I_3$	$Z$	$\bar{Z}$
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

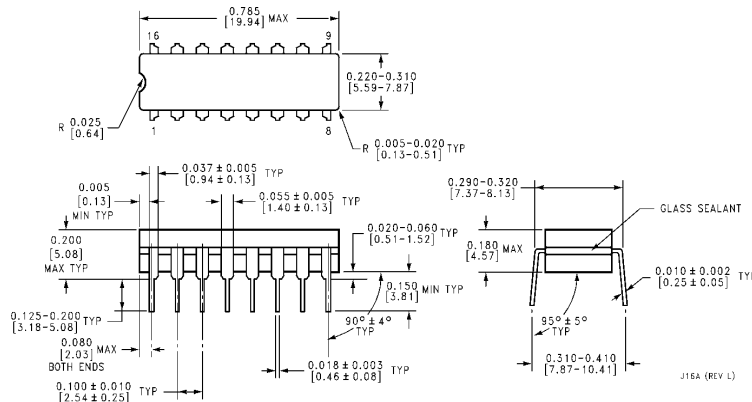
H = HIGH voltage level  
L = LOW voltage level  
X = Immaterial

## Logic Diagram

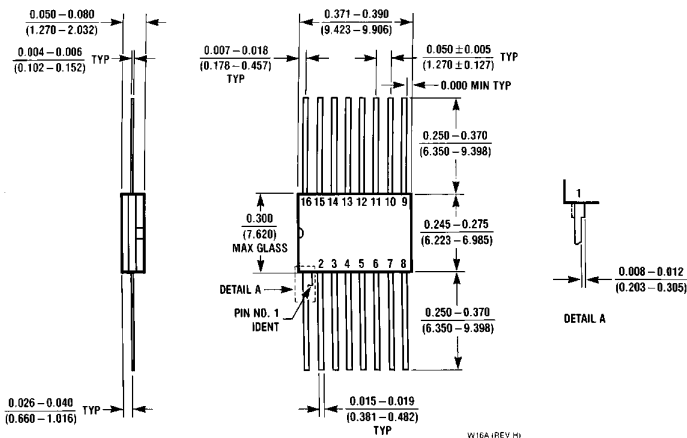


TL/F/9602-3

**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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