

93L09

Dual 4-Input Multiplexer

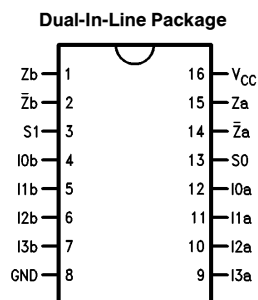
General Description

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

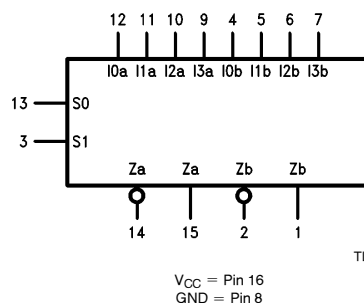
- Multifunction capability
- On-chip select logic decoding
- Fully buffered complementary outputs

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 _{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, I _I = −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
I _I	Input Current @ Max Input Voltage	V _{CC} = Max, V _I = 5.5V			1	mA
I _{IH}	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 $V_{CC} = +5.0V, T_A = +25^\circ C$

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

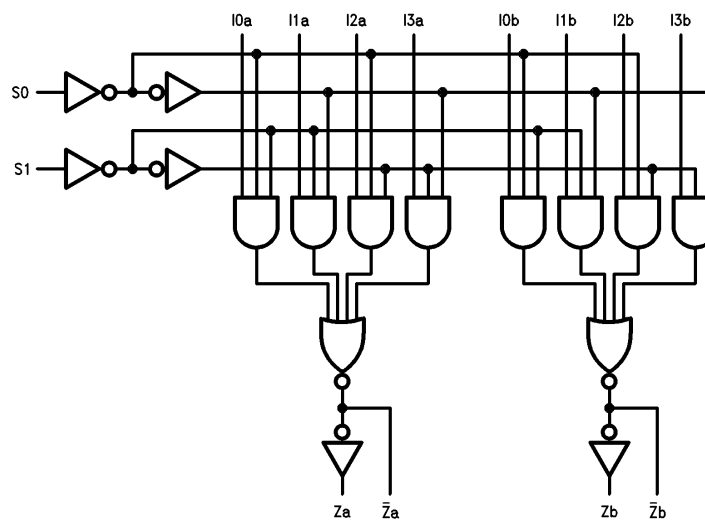
Select Inputs		Inputs (a or b)				Outputs (a or b)	
S_0	S_1	I_0	I_1	I_2	I_3	Z	$\bar{Z}$
L	L	L	X	X	X	L	H
L	L	H	X	X	X	H	L
H	L	X	L	X	X	L	H
H	L	X	H	X	X	H	L
L	H	X	X	L	X	L	H
L	H	X	X	H	X	H	L
H	H	X	X	X	L	L	H
H	H	X	X	X	H	H	L

H = HIGH voltage level

L = LOW voltage level

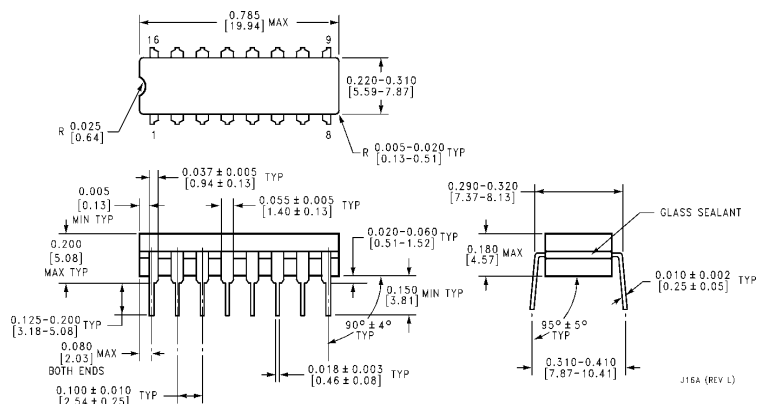
X = Immaterial

Logic Diagram

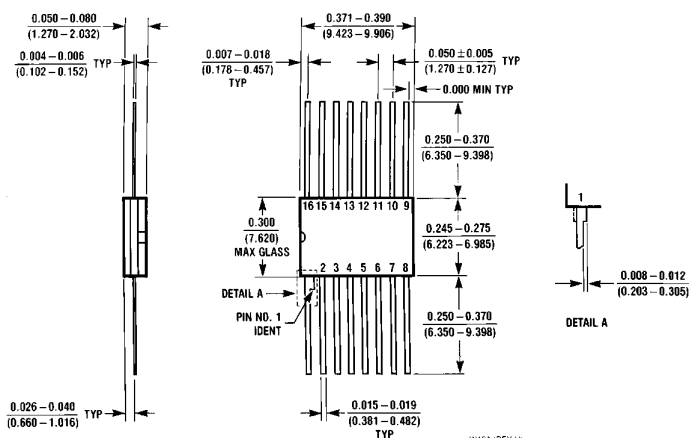


TL/F/9602-3

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

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

National Semiconductor Europe
 Fax: (+49) 0-180-530 85 86
 Email: cnjwge@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

National Semiconductor Hong Kong Ltd.
 19th 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: 81-043-299-2309
 Fax: 81-043-299-2408