National Semiconductor

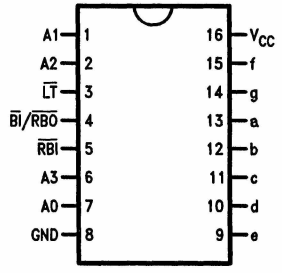
54LS249/DM74LS249
BCD to 7-Segment Decoder (with Open-Collector Outputs)

General Description

The 'LS249 has active HIGH open-collector outputs and incorporates the Lamp Test and $\overline{BI}/\overline{RBO}$ inputs. Additionally, the 'LS249 will light the top bar (segment a) for numeral 6 and the bottom bar (segment d) for numeral 9.

Connection Diagram

Dual-In-Line Package



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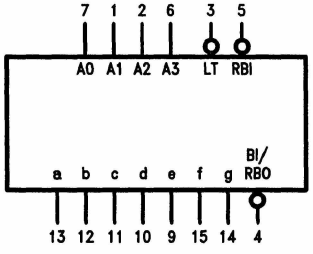
Order Number 54LS249DMBQ, 54LS249FMBQ or DM74LS249N
See NS Package Number J16A, N16E or W16A

Logic Symbol



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V_{CC} = Pin 16
GND = Pin 8

Pin Names	Description
A_0–A_3	BCD Inputs
$\overline{BI}$	Blanking Input (Active LOW)
$\overline{LT}$	Lamp Test Input (Active LOW)
$\overline{BI}/\overline{RBO}$	Blanking Input (Active LOW) or Ripple Blanking Output (Active LOW)
a–g	Segment Outputs (Active HIGH)

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	7V
Operating Free Air Temperature Range	
54LS	−55°C to +125°C
DM74LS	0°C to +70°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	54LS249			DM74LS249			Units
		Min	Nom	Max	Min	Nom	Max	
V_{CC}	Supply Voltage	4.5	5	5.5	4.75	5	5.25	V
V_{IH}	High Level Input Voltage	2			2			V
V_{IL}	Low Level Input Voltage			0.7			0.8	V
I_{OH}	High Level Output Current			−0.25			−0.25	mA
I_{OL}	Low Level Output Current			4			8	mA
T_A	Free Air Operating Temperature	−55		125	0		70	°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 = −18 mA				−1.5	V
V_{OH}	High Level Output Voltage	V_{CC} = Min, I_{OH} = Max, V_{IL} = Max	54LS	2.4			V
			DM74	2.7	3.4		
V_{OL}	Low Level Output Voltage	V_{CC} = Min, I_{OL} = Max, V_{IH} = Min	54LS			0.4	V
			DM74		0.35	0.5	
		I_{OL} = 4 mA, V_{CC} = Min	DM74		0.25	0.4	
I_I	Input Current @ Max Input Voltage	V_{CC} = Max, V_I = 10V				0.1	mA
I_{IH}	High Level Input Current	V_{CC} = Max, V_I = 2.7V				20	μA
I_{IL}	Low Level Input Current	V_{CC} = Max, V_I = 0.4V	Inputs	−0.03		−0.4	mA
			BI/$\overline{RBO}$	−0.09		−1.2	
I_{OS}	Short Circuit Output Current	V_{CC} = Max (Note 2)	54LS	−0.3		−2.0	mA
			DM74	−20		−100	
I_{CC}	Supply Current	V_{CC} = Max, V_{IN} = 4.5V				15	mA

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

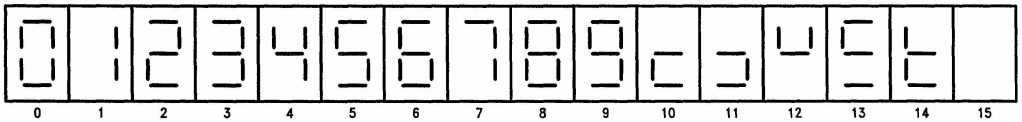
Note 2: Not more than one output should be shorted at a time, and the duration should not exceed one second.

Switching Characteristics

at V_{CC} = +5.0V, T_A = +25°C (See Section 1 for Test Waveforms and Output Load)

Symbol	Parameter	R_L = 2 kΩ, C_L = 15 pF		Units
		Min	Max	
t_{PLH} t_{PHL}	Propagation Delay Time A_n to a–g (54LS R_L = 2 kΩ)		100 100	ns
t_{PLH} t_{PHL}	Propagation Delay Time $\overline{BI}$ to a–g (54LS R_L = 6 kΩ)		100 100	ns

Numerical Designations—Resultant Displays



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Truth Table

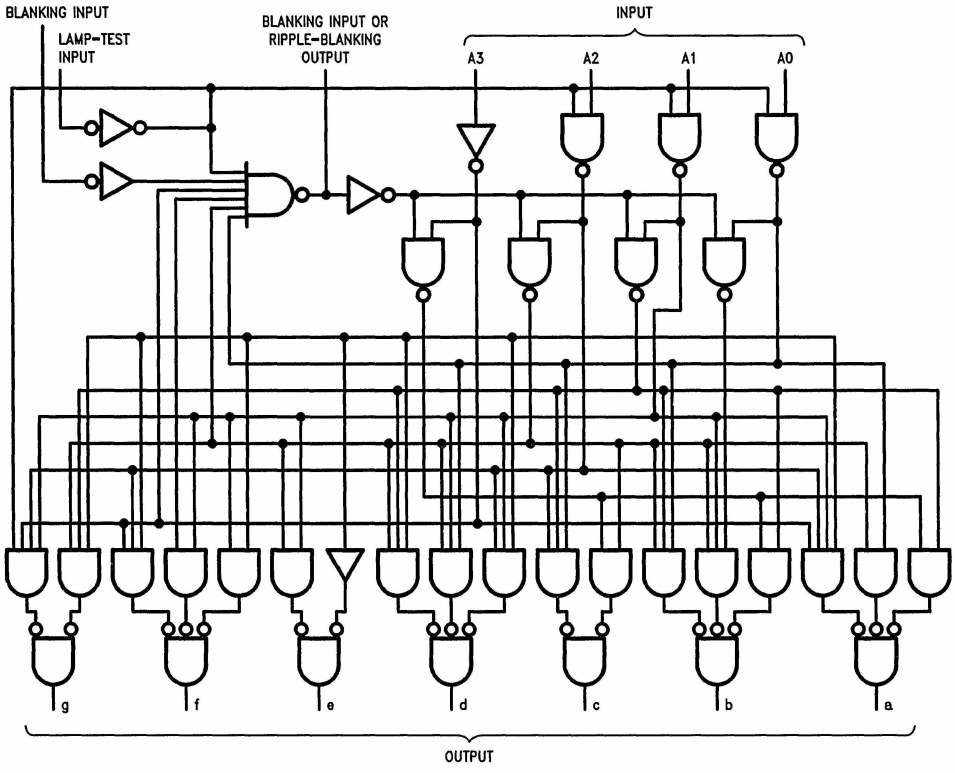
Decimal or Function	Inputs						Outputs							Note
	$\overline{LT}$	A_3	A_2	A_1	A_0	$\overline{BI/RBO}$	a	b	c	d	e	f	g	
0	H	L	L	L	L	H	H	H	H	H	H	H	L	1
1	H	L	L	L	H	H	L	H	H	L	L	L	L	1
2	H	L	L	H	L	H	H	H	L	H	H	L	H	
3	H	L	L	H	H	H	H	H	H	H	L	L	H	
4	H	L	H	L	L	H	L	H	H	L	L	H	H	
5	H	L	H	L	H	H	H	L	H	H	L	H	H	
6	H	L	H	H	L	H	L	L	H	H	H	H	H	
7	H	L	H	H	H	H	H	H	H	L	L	L	L	
8	H	H	L	L	L	H	H	H	H	H	H	H	H	
9	H	H	L	L	H	H	H	H	H	L	L	H	H	
10	H	H	L	H	L	H	L	L	L	H	H	L	H	
11	H	H	L	H	H	H	L	L	H	H	L	L	H	
12	H	H	H	L	L	H	L	H	L	L	L	H	H	
13	H	H	H	L	H	H	H	L	L	H	L	H	H	
14	H	H	H	H	L	H	L	L	L	H	H	H	H	
15	H	H	H	H	H	H	L	L	L	L	L	L	L	
$\overline{BI}$	X	X	X	X	X	L	L	L	L	L	L	L	L	2
$\overline{LT}$	L	X	X	X	X	H	H	H	H	H	H	H	H	3

Note 1: $\overline{BI/RBO}$ is wired-AND logic serving as blanking input ($\overline{BI}$) and/or ripple-blanking output ($\overline{RBO}$). The blanking out ($\overline{BI}$) must be open or held at a HIGH level when output functions 0 through 15 are desired. X = input may be HIGH or LOW.

Note 2: When a LOW level is applied to the blanking input (forced condition) all segment outputs go to a LOW level, regardless of the state of any other input condition.

Note 3: When the blanking input/ripple-blanking output ($\overline{BI/RBO}$) is open or held at a HIGH level, and a LOW level is applied to lamp test input, all segment outputs go to a HIGH level.

Logic Diagram



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