



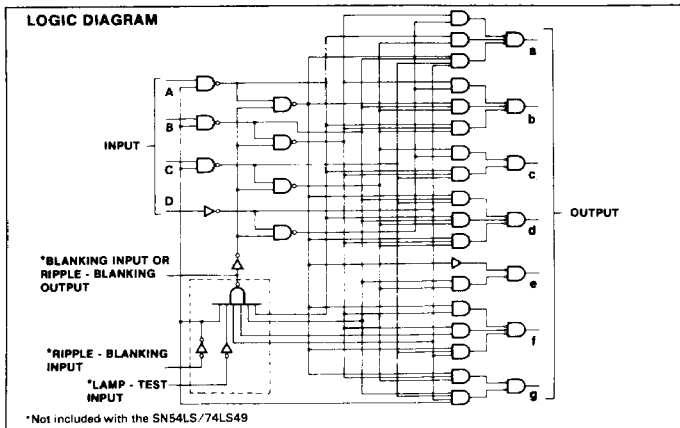
MOTOROLA

DESCRIPTION — The SN54LS/74LS48 and SN54LS/74LS49 are BCD to 7-Segment Decoders consisting of NAND gates, input buffers and seven AND-OR-INVERT gates. The LS49 offers active HIGH open-collector outputs for current-sourcing applications to drive logic circuits or discrete, active components. Seven NAND gates and one driver are connected in pairs to make BCD data and its complement available to the seven decoding AND-OR-INVERT gates. The remaining NAND gate and three input buffers provide lamp test, blanking input/ripple-blanking input for the LS48. Four NAND gates and four input buffers provide BCD data and its complement and a buffer provides blanking input for the LS49.

The circuits accept 4-bit binary-coded-decimal (BCD) and, depending on the state of the auxiliary inputs, decodes this data to drive other components. The relative positive logic output levels, as well as conditions required at the auxiliary inputs, are shown in the truth tables.

The LS48 circuit incorporates automatic leading and/or trailing edge zero-blanking control (RBI and RBO). Lamp Test (LT) may be activated any time when the BI/RBO node is HIGH. Both devices contain an overriding blanking input (BI) which can be used to control the lamp intensity or to inhibit the outputs.

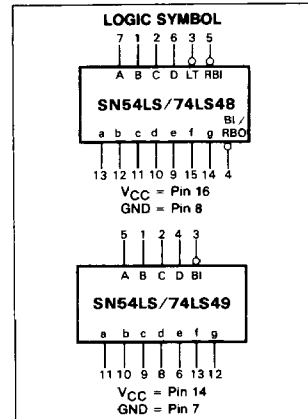
- LAMP INTENSITY MODULATION CAPABILITY
- INTERNAL PULL-UPS ELIMINATE NEED FOR EXTERNAL RESISTORS ON SN54LS/74LS48
- OPEN COLLECTOR OUTPUTS ON SN54LS/74LS49
- INPUT CLAMP DIODES ELIMINATE HIGH-SPEED TERMINATION EFFECTS



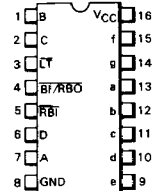
SN54LS/74LS48 SN54LS/74LS49

BCD TO 7-SEGMENT DECODER

LOW POWER SCHOTTKY

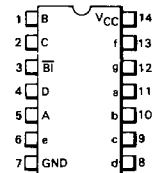


DIP (TOP VIEW) SN54LS/74LS48



J Suffix — Case 620-08 (Ceramic)
N Suffix — Case 648-05 (Plastic)

SN54LS/74LS49



J Suffix — Case 632-07 (Ceramic)
N Suffix — Case 646-05 (Plastic)

5

PIN NAMES

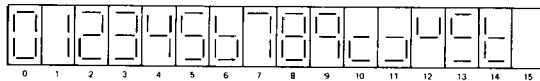
A, B, C, D,	BCD Inputs
RBI	Ripple Blanking (Active Low) Input
LT	Lamp Test (Active Low) Input
BI/RBO	Blanking Input or Ripple Blanking Output (Active Low)
Bi	Blanking (Active Low) Input
a to g	Outputs (Note b)

LOADING (Note a)

	HIGH	LOW
	0.5 U.L.	0.25 U.L.
	0.5 U.L.	0.25 U.L.
	0.5 U.L.	0.25 U.L.
	0.5 U.L.	0.75 U.L.
	1.2 U.L.	2(1) U.L.
	0.5 U.L.	0.25 U.L.
Open Collector		3.75 (1.25) U.L. (48)
Open Collector		5 (2.5) U.L. (49)

NOTES:

- a) Unit Load (U.L.) = 40 μ A HIGH/1.6 mA LOW
- b) Output current measured at $V_{OUT} = 0.5$ V
- Output LOW drive factor is SN54LS/74LS48: 1.25 U.L. for Military (54), 3.75 U.L. for Commercial (74).
- SN54LS/74LS49: 2.5 U.L. for Military (54), 5 U.L. for Commercial (74) Temperature Ranges.



NUMERICAL DESIGNATIONS – RESULTANT DISPLAYS

**TRUTH TABLE
SN64LS/74LS48**

DECIMAL OR FUNCTION	INPUTS					OUTPUTS							NOTE	
	LT	RBI	D	C	B	A	Bi/RBO	a	b	c	d	e		f
0	H	H	L	L	L	L	H	H	H	H	H	H	L	1
1	H	X	L	L	L	L	H	H	L	H	L	L	L	1
2	H	X	L	L	L	H	H	H	L	H	L	L	L	
3	H	X	L	L	H	L	H	H	H	L	H	L	L	
4	H	X	L	H	L	L	H	H	H	L	L	L	H	
5	H	X	L	H	L	H	H	H	H	L	H	L	H	
6	H	X	L	H	H	L	H	L	L	H	H	H	H	
7	H	X	L	H	H	H	H	H	H	L	L	L	L	
8	H	X	H	L	L	L	H	H	H	H	H	H	H	
9	H	X	H	L	L	H	H	H	H	L	L	L	H	
10	H	X	H	L	H	L	H	L	L	L	H	L	H	
11	H	X	H	L	H	H	H	L	L	H	L	L	L	
12	H	X	H	H	L	L	H	L	H	L	L	L	H	
13	H	X	H	H	L	H	H	L	L	H	L	H	H	
14	H	X	H	H	H	L	H	L	L	L	H	H	H	
15	H	X	H	H	H	H	H	L	L	L	L	L	L	
Bi	X	X	X	X	X	X	L	L	L	L	L	L	L	2
RBI	H	L	L	L	L	L	L	L	L	L	L	L	L	3
LT	L	X	X	X	X	X	H	H	H	H	H	H	H	4

NOTES:

- (1) BI/RBO is wired-AND logic serving as blanking input (Bi) and/or ripple-blanking output (RBO). The blanking out (Bi) must be open or held at a HIGH level when output functions 0 through 15 are desired, and ripple-blanking input (RBI) must be open or at a HIGH level if blanking of a decimal 0 is not desired. X=input may be HIGH or LOW.
- (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.
- (3) When ripple-blanking input (RBI) and inputs A, B, C, and D are at LOW level, with the lamp test input at HIGH level, all segment outputs go to a HIGH level and the ripple-blanking output (RBO) goes to a LOW level (response condition).
- (4) When the blanking input/ripple-blanking output (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 LOW level.

**TRUTH TABLE
SN64LS/74LS49**

DECIMAL OR FUNCTION	INPUTS					OUTPUTS							NOTE
	D	C	B	A	Bi	a	b	c	d	e	f	g	
0	L	L	L	L	H	H	H	H	H	H	L	1	
1	L	L	L	H	H	L	H	L	L	L	L		
2	L	L	H	L	H	H	L	H	L	L	L		
3	L	L	H	H	L	H	H	L	L	L	H		
4	L	H	L	L	H	L	H	L	L	L	H		
5	L	H	L	H	H	L	H	L	L	L	H		
6	L	H	H	L	H	L	L	H	H	H	H		
7	L	H	H	H	H	L	H	L	L	L	L		
8	H	L	L	L	H	H	H	L	L	L	L		
9	H	L	L	H	H	L	H	L	L	L	L		
10	H	L	H	L	L	H	L	L	L	L	H		
11	H	L	H	H	L	L	H	L	L	L	H		
12	H	H	L	L	H	L	L	L	L	L	H		
13	H	H	L	H	H	L	L	L	L	H	H		
14	H	H	H	L	H	L	L	L	H	H	H		
15	H	H	H	H	L	L	L	L	L	L	L		
Bi	X	X	X	X	L	L	L	L	L	L	L	2	

NOTES:

- (1) The blanking input must be open or held at a HIGH level when output functions 0 through 15 are desired.
- (2) When a LOW level is applied to the blanking input all segment outputs go to a LOW level regardless of the state of any other input condition. X = input may be HIGH or LOW.

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

GUARANTEED OPERATING RANGES

SYMBOL	PARAMETER		MIN	TYP	MAX	UNIT
V _{CC}	Supply Voltage	54 74	4.5 4.75	5.0 5.0	5.5 5.25	V
T _A	Operating Ambient Temperature Range	54 74	-55 0	25 25	125 70	°C
I _{OH}	Output Current — High \bar{a} to \bar{g}	54,74			-100	μA
I _{OH}	Output Current — High $\bar{B}/\bar{R}\bar{B}\bar{O}$	54,74			-50	μA
I _{OL}	Output Current — Low \bar{a} to \bar{g}	54 74			2.0 6.0	mA
I _{OL}	Output Current — Low $\bar{B}/\bar{R}\bar{B}\bar{O}$ $\bar{B}/\bar{R}\bar{B}\bar{O}$	54 74			1.6 3.2	mA

DC CHARACTERISTICS OVER OPERATING TEMPERATURE RANGE (unless otherwise specified)

SYMBOL	PARAMETER		LIMITS			UNITS	TEST CONDITIONS
			MIN	TYP	MAX		
V _{IH}	Input HIGH Voltage		2.0			V	Guaranteed Input HIGH Voltage for All Inputs
V _{IL}	Input LOW Voltage	54			0.7	V	Guaranteed Input LOW Voltage for All Inputs
		74			0.8		
V _{IK}	Input Clamp Diode Voltage				-1.5	V	V _{CC} = MIN, I _{IN} = -18 mA
V _{OH}	Output HIGH Voltage		2.4	4.2		μA	V _{CC} = MIN, I _{OH} = -50 μA, V _{IN} = V _{IH} or U.L. per Truth Table
I _O	Output Current \bar{a} to \bar{g}		-1.3	-2.0		mA	V _{CC} = MIN, V _O = 0.85 V Input Conditioner as for V _{OH}
V _{OL}	Output LOW Voltage \bar{a} to \bar{g}	54,74			0.4	V	I _{OL} = 2.0 mA V _{CC} = MIN, V _{IH} = 2.0 V
		74			0.5	V	I _{OL} = 6.0 mA V _{IL} = V _{IL} MAX
V _{OL}	Output LOW Voltage $\bar{B}/\bar{R}\bar{B}\bar{O}$	54,74			0.4	V	I _{OL} = 1.6 mA V _{CC} = MAX, V _{IH} = 2.0 V
		74			0.5	V	I _{OL} = 3.2 mA V _{IL} = V _{IL} MAX
I _{IH}	Input HIGH Current (Except $\bar{B}/\bar{R}\bar{B}\bar{O}$)				20	μA	V _{CC} = MAX, V _{IN} = 2.7 V
					0.1	mA	V _{CC} = MAX, V _{IN} = 7.0 V
I _{IL}	Input LOW Current (Except $\bar{B}/\bar{R}\bar{B}\bar{O}$)				-0.4	mA	V _{CC} = MAX, V _{IN} = 0.4 V
I _{IL}	Input LOW Current $\bar{B}/\bar{R}\bar{B}\bar{O}$				-1.2	mA	V _{CC} = MAX, V _{IN} = 0.4 V
I _{CC}	Power Supply Current			25	38	mA	V _{CC} = MAX
I _{OS}	Short Circuit Current $\bar{B}/\bar{R}\bar{B}\bar{O}$		-0.3		-2.0	mA	V _{CC} = MAX

AC CHARACTERISTICS: V_{CC} = 5.0 V T_A = 25°C

SYMBOL	PARAMETER	LIMITS			UNITS	TEST CONDITIONS
		MIN	TYP	MAX		
t _{PHL}	Propagation delay time, HIGH-to-LOW level output from A Input			100	ns	C _L = 15 pF, R _L = 4.0 kΩ
t _{PLH}	Propagation delay time, LOW-to-HIGH level output from A Input			100	ns	
t _{PHL}	Propagation delay time, HIGH-to-LOW level output from $\bar{R}\bar{B}\bar{I}$ Input			100	ns	C _L = 15 pF, R _L = 6.0 kΩ
t _{PLH}	Propagation delay time, LOW-to-HIGH level output from $\bar{R}\bar{B}\bar{I}$ Input			100	ns	

GUARANTEED OPERATING RANGES

SYMBOL	PARAMETER		MIN	TYP	MAX	UNIT
V _{CC}	Supply Voltage	54	4.5	5.0	5.5	V
		74	4.75	5.0	5.25	
T _A	Operating Ambient Temperature Range	54	-55	25	125	°C
		74	0	25	70	
VOH	Output Voltage — High	54, 74			5.5	V
I _{OL}	Output Current — Low	54			4.0	mA
		74			8.0	

DC CHARACTERISTICS OVER OPERATING TEMPERATURE RANGE (unless otherwise specified)

SYMBOL	PARAMETER	LIMITS			UNITS	TEST CONDITIONS
		MIN	TYP	MAX		
V _{IH}	Input HIGH Voltage	2.0			V	Guaranteed Input HIGH Voltage
V _{IL}	Input LOW Voltage	54		0.7	V	Guarantee Input LOW Voltage
		74		0.8	V	
V _{IK}	Input Clamp Diode Voltage			-1.5	V	V _{CC} = MIN, I _{IN} = -18 mA
I _{OH}	Output HIGH Current			250	μA	V _{CC} = MIN, V _{IH} = 2.0 V V _{IL} = V _{IL} MAX, V _{OH} = 5.5 V
V _{OL}	Output LOW Voltage	54, 74		0.4	V	I _{OL} = 4.0 mA, V _{CC} = MIN, V _{IH} = 2.0 V
		74		0.5	V	I _{OL} = 8.0 mA, V _{IL} = V _{IL} MAX
I _{IH}	Input Current HIGH			20	μA	V _{CC} = MAX, V _{IN} = 2.7 V
I _{IL}	Input Current LOW			0.1	mA	V _{CC} = MAX, V _{IN} = 7.0 V
I _{IL}	Input Current LOW			-0.4	mA	V _{CC} = MAX, V _{IN} = 0.4 V
I _{CC}	Power Supply Current		8.0	15	mA	V _{CC} = MAX

5

AC CHARACTERISTICS: V_{CC} = 5.0 V, T_A = 25°

SYMBOL	PARAMETER	LIMITS			UNITS	TEST CONDITIONS
		MIN	TYP	MAX		
t _{PHL}	Propagation delay time, HIGH-to-LOW level output from A Input			100	ns	C _L = 15 pF, R _L = 2.0 kΩ
t _{PLH}	Propagation delay time, LOW-to-HIGH level output from A Input			100	ns	
t _{PHL}	Propagation delay time, HIGH-to-LOW level output from RBI Input			100	ns	C _L = 15 pF, R _L = 6.0 kΩ
t _{PLH}	Propagation delay time, LOW-to-HIGH level output from RBI Input			100	ns	