MOTOROLA

SN54LS/74LS147
SN54LS/74LS148
SN54LS/74LS748

10-LINE-TO-4-LINE AND 8-LINE-TO-3-LINE PRIORITY ENCODERS

LOW POWER SCHOTTKY

DESCRIPTION — The SN54LS/74LS147 and the SN54LS/74LS148 are Priority Encoders. They provide priority decoding of the inputs to ensure that only the highest order data line is encoded. Both devices have data inputs and outputs which are active at the low logic level.

The LS147 encodes nine data lines to four-line (8-4-2-1) BCD. The implied decimal zero condition does not require an input condition because zero is encoded when all nine data lines are at a high logic level.

The LS148 encodes eight data lines to three-line (4-2-1) binary (octal). By providing cascading circuitry (Enable Input EI and Enable Output EO) octal expansion is allowed without needing external circuitry.

The SN54LS/74LS748 is a proprietary Motorola part incorporating a built-in deglitcher network which minimizes glitches on the GS output. The glitch occurs on the negative going transition of the EI input when data inputs 0-7 are at logical ones.

The only dc parameter differences between the LS148 and the LS748 are that (1) Pin 10 (input 0) has a fan-in of 2 on the LS748 versus a fan-in of 1 on the LS148; (2) Pins 1, 2, 3, 4, 11, 12 and 13 (inputs 1, 2, 3, 4, 5, 6, 7) have a fan-in of 3 on the LS748 versus a fan-in of 2 on the LS148.

The only ac difference is that t_{PHL} from EI to EO is changed from 40 to 45 ns.

SN54LS/74LS147
FUNCTION TABLE

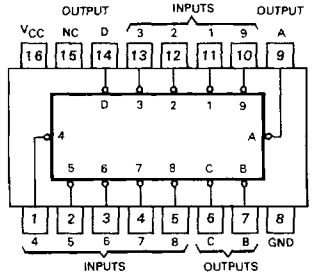
INPUTS									OUTPUTS			
1	2	3	4	5	6	7	8	9	D	C	B	A
H	H	H	H	H	H	H	H	H	H	H	H	H
X	X	X	X	X	X	X	X	L	L	H	H	L
X	X	X	X	X	X	X	L	H	L	H	H	H
X	X	X	X	X	X	L	H	H	H	L	L	L
X	X	X	X	X	L	H	H	H	H	L	L	H
X	X	X	X	L	H	H	H	H	H	L	H	L
X	X	X	L	H	H	H	H	H	H	L	H	H
X	X	L	H	H	H	H	H	H	H	H	L	L
X	L	H	H	H	H	H	H	H	H	H	L	H
L	H	H	H	H	H	H	H	H	H	H	H	L

SN54LS/74LS148
SN54LS/74LS748
FUNCTION TABLE

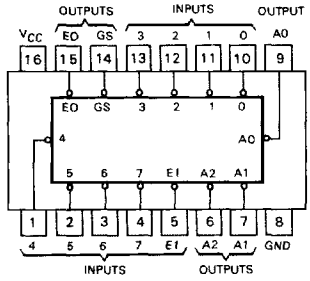
INPUTS								OUTPUTS				
EI	0	1	2	3	4	5	6	7	A2	A1	A0	GS	EO
H	X	X	X	X	X	X	X	X	H	H	H	H	H
L	H	H	H	H	H	H	H	H	H	H	H	H	L
L	X	X	X	X	X	X	X	L	L	L	L	L	H
L	X	X	X	X	X	X	L	H	L	L	H	L	H
L	X	X	X	X	X	L	H	H	L	H	L	L	H
L	X	X	X	X	L	H	H	H	L	H	H	L	H
L	X	X	X	L	H	H	H	H	H	L	L	L	H
L	X	X	L	H	H	H	H	H	H	L	H	L	H
L	X	L	H	H	H	H	H	H	H	H	L	L	H
L	L	H	H	H	H	H	H	H	H	H	H	L	H

H = high logic level, L = low logic level, X = irrelevant

SN54LS/74LS147
(TOP VIEW)



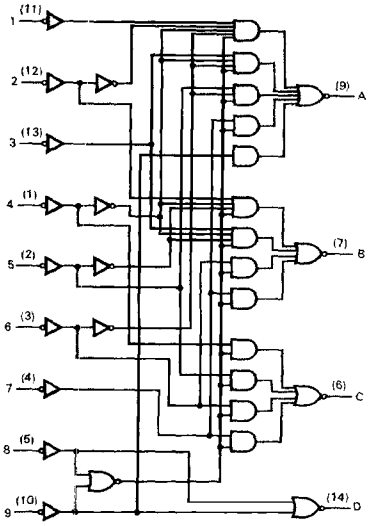
SN54LS/74LS148
SN54LS/74LS748
(TOP VIEW)



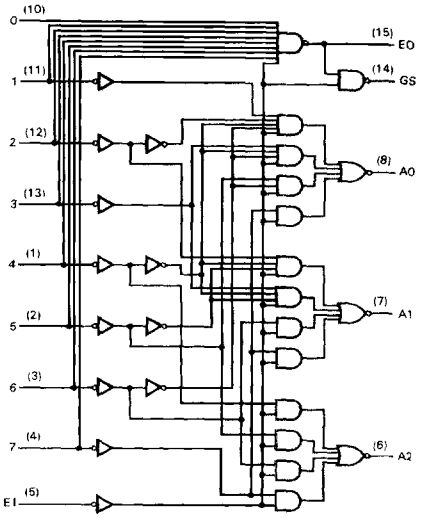
J Suffix — Case 620-08 (Ceramic)
N Suffix — Case 648-05 (Plastic)

4

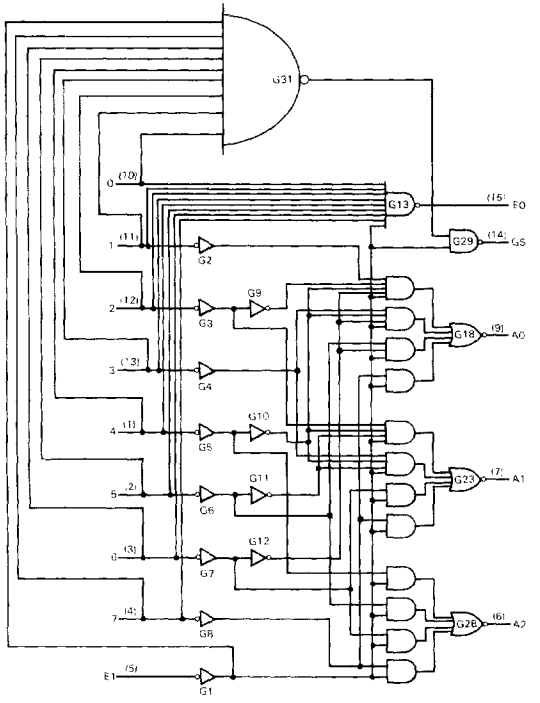
FUNCTIONAL BLOCK DIAGRAMS



SN54LS/74LS147



SN54LS/74LS148



SN54LS/74LS748

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	54,74			−0.4	mA
I_{OL}	Output Current — Low	54 74			4.0 8.0	mA

DC CHARACTERISTICS OVER OPERATING TEMPERATURE RANGE *(unless otherwise specified)*

SYMBOL	PARAMETER		LIMITS MIN	LIMITS TYP	LIMITS MAX	UNITS	TEST CONDITIONS	
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			−0.65	−1.5	V	V_{CC} = MIN, I_{IN} = −18 mA	
V_{OH}	Output HIGH Voltage	54	2.5	3.5		V	V_{CC} = MIN, I_{OH} = MAX, V_{IN} = V_{IH} or V_{IL} per Truth Table	
		74	2.7	3.5		V		
V_{OL}	Output LOW Voltage	54,74		0.25	0.4	V	I_{OL} = 4.0 mA	V_{CC} = V_{CC} MIN, V_{IN} = V_{IL} or V_{IH} per Truth Table
		74		0.35	0.5	V	I_{OL} = 8.0 mA	
I_{IH}	Input HIGH Current All Others Input 0 (LS748) Inputs 1-7 (LS148) Inputs 1-7 (LS748)				20 40 40 60	μA	V_{CC} = MAX, V_{IN} = 2.7 V	
	All Others Input 0 (LS748) Inputs 1-7 (LS148) Inputs 1-7 (LS748)				0.1 0.2 0.2 0.3	mA	V_{CC} = MAX, V_{IN} = 7.0 V	
I_{IL}	Input LOW Current All others Input 0 (LS748) Inputs 1-7 (LS148) Inputs 1-7 (LS748)				−0.4 −0.8 −0.8 −1.2	mA	V_{CC} = MAX, V_{IN} = 0.4 V	
I_{OS}	Short Circuit Current		−20		−100	mA	V_{CC} = MAX	
I_{CC}	Power Supply Current				20	mA	V_{CC} = MAX, Inputs 7, EI, GND, Others Open	
					17	mA	V_{CC} = MAX, All open	

4

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

SN54LS/74LS147

SYMBOL	FROM (INPUT)	TO (OUTPUT)	WAVEFORM	LIMITS MIN	LIMITS TYP	LIMITS MAX	UNIT	TEST CONDITIONS
t_{PLH}	Any	Any	In-phase		12	18	ns	C_L = 15 pF, R_L = 2 kΩ
t_{PHL}			output		12	18		
t_{PLH}	Any	Any	Out-of-phase		21	33	ns	
t_{PHL}			output		15	23		

SN54LS/74LS148
SN54LS/74LS748

SYMBOL	FROM (INPUT)	TO (OUTPUT)	WAVEFORM	LIMITS MIN	LIMITS TYP	LIMITS MAX	UNIT	TEST CONDITIONS
t_{PLH}	1 thru 7	A0, A1, or A2	In-phase		14	18	ns	C_L = 15 pF, R_L = 2 kΩ,
t_{PHL}			output		15	25		
t_{PLH}	1 thru 7	A0, A1, or A2	Out-of-phase		20	36	ns	
t_{PHL}			output		16	29		
t_{PLH}	0 thru 7	EO	Out-of-phase		7.0	18	ns	
t_{PHL}			output		25	40		
t_{PLH}	0 thru 7	GS	In-phase		35	55	ns	
t_{PHL}			output		9.0	21		
t_{PLH}	EI	A0, A1, or A2	In-phase		16	25	ns	
t_{PHL}			output		12	25		
t_{PLH}	EI	GS	In-phase		12	17	ns	
t_{PHL}			output		14	36		
t_{PLH}	EI	EO	In-phase		12	21	ns	
t_{PHL}			output		28 30	40 45		(LS148) (LS748)

4