

SN54147, SN54148, SN54LS147, SN54LS148
SN74147, SN74148 (TIM9907), SN74LS147, SN74LS148
10-LINE TO 4-LINE AND 8-LINE TO 3-LINE PRIORITY ENCODERS

SDLS053B – OCTOBER 1976 – REVISED MAY 2004

description/ordering information

These TTL encoders feature priority decoding of the inputs to ensure that only the highest-order data line is encoded. The '147 and 'LS147 devices encode nine data lines to four-line (8-4-2-1) BCD. The implied decimal zero condition requires no input condition, as zero is encoded when all nine data lines are at a high logic level. The '148 and 'LS148 devices encode eight data lines to three-line (4-2-1) binary (octal). Cascading circuitry (enable input EI and enable output EO) has been provided to allow octal expansion without the need for external circuitry. For all types, data inputs and outputs are active at the low logic level. All inputs are buffered to represent one normalized Series 54/74 or 54/74LS load, respectively.

ORDERING INFORMATION

T _A	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
0°C to 70°C	PDIP – N	Tube	SN74LS148N	SN74LS148N
	SOIC – D	Tube	SN74LS148D	LS148
		Tape and reel	SN74LS148DR	
	SOP – NS	Tape and reel	SN74LS148NSR	74LS148
–55°C to 125°C	CDIP – J	Tube	SNJ54LS148J	SNJ54LS148J
	CFP – W	Tube	SNJ54LS148W	SNJ54LS148W
	LCCC – FK	Tube	SNJ54LS148FK	SNJ54LS148FK

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.

FUNCTION TABLE – '147, 'LS147

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	L	H	H	H	H	H	L	L	L
X	X	X	L	H	H	H	H	H	H	L	H	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

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



SN54147, SN54148, SN54LS147, SN54LS148
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10-LINE TO 4-LINE AND 8-LINE TO 3-LINE PRIORITY ENCODERS
SDLS053B – OCTOBER 1976 – REVISED MAY 2004

FUNCTION TABLE – '148, 'LS148

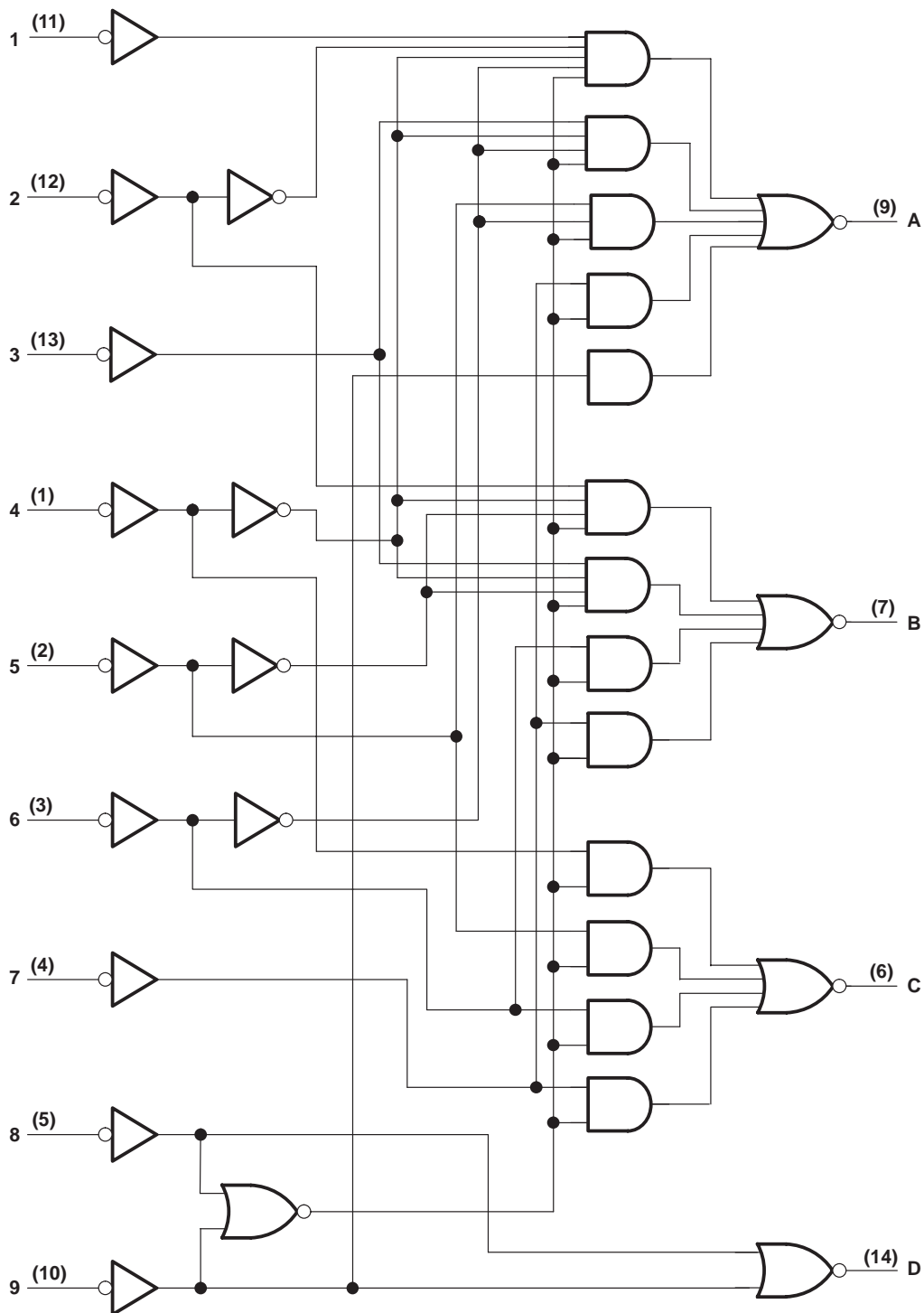
EI	INPUTS								OUTPUTS				
	0	1	2	3	4	5	6	7	A2	A1	A0	GS	EO
H	X	X	X	X	X	X	X	X	H	H	H	H	H
L	H	H	H	H	H	H	H	H	H	H	H	H	L
L	X	X	X	X	X	X	X	L	L	L	L	L	H
L	X	X	X	X	X	X	L	H	L	L	H	L	H
L	X	X	X	X	X	L	H	H	L	H	L	L	H
L	X	X	X	L	H	H	H	H	H	L	L	L	H
L	X	X	L	H	H	H	H	H	H	L	H	L	H
L	X	L	H	H	H	H	H	H	H	H	L	L	H
L	L	H	H	H	H	H	H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

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

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

SDLS053B - OCTOBER 1976 - REVISED MAY 2004

'147, 'LS147 logic diagram (positive logic)



Pin numbers shown are for D, J, N, and W packages.

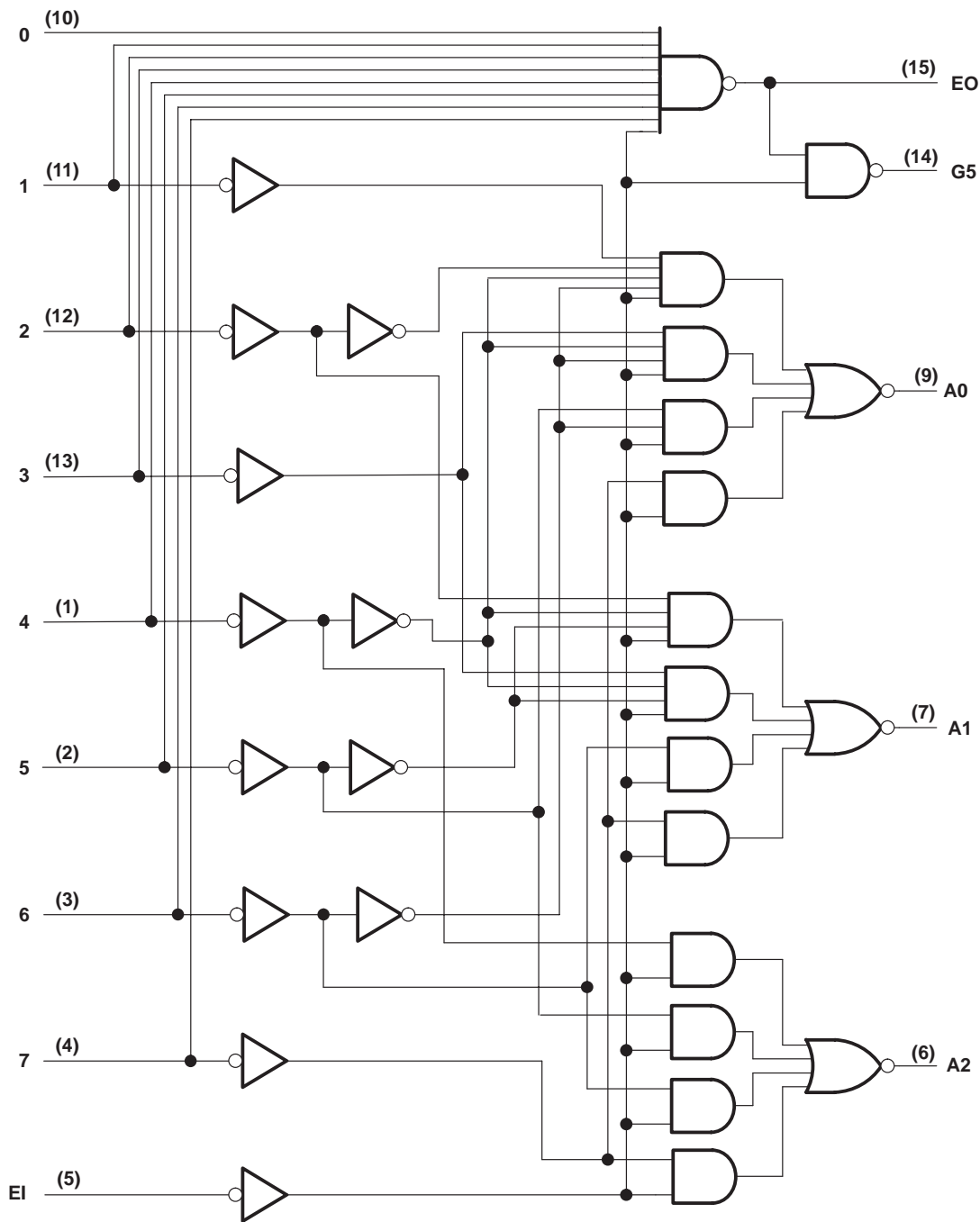


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**SN54147, SN54148, SN54LS147, SN54LS148
SN74147, SN74148 (TIM9907), SN74LS147, SN74LS148
10-LINE TO 4-LINE AND 8-LINE TO 3-LINE PRIORITY ENCODERS**

SDLS053B - OCTOBER 1976 - REVISED MAY 2004

'148, 'LS148 logic diagram (positive logic)



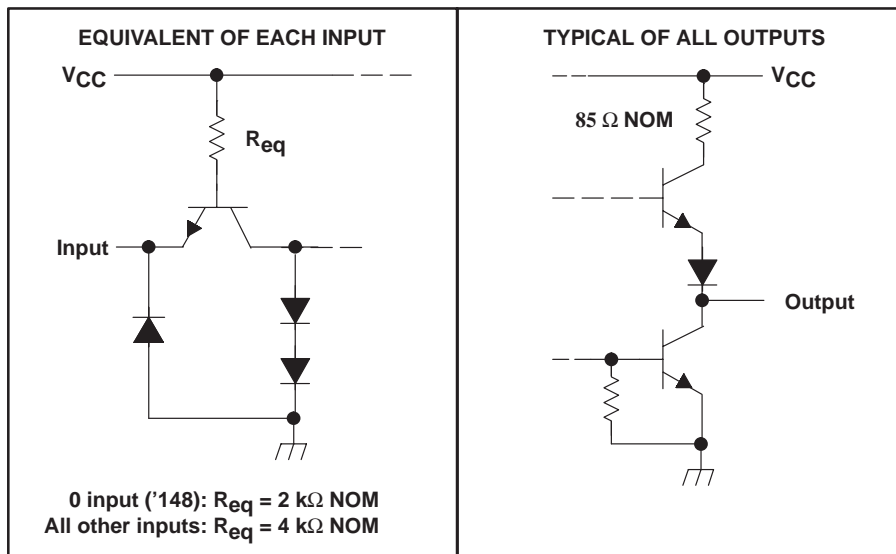
Pin numbers shown are for D, J, N, NS, and W packages.

**SN54147, SN54148, SN54LS147, SN54LS148
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 10-LINE TO 4-LINE AND 8-LINE TO 3-LINE PRIORITY ENCODERS**

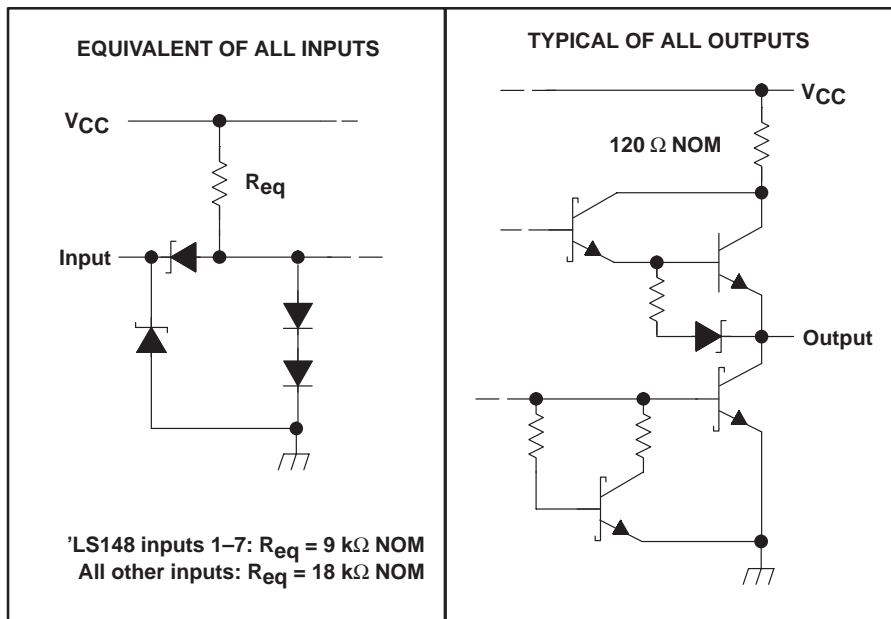
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schematics of inputs and outputs

'147, '148



'LS147, 'LS148



**SN54147, SN54148, SN54LS147, SN54LS148
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SDLS053B – OCTOBER 1976 – REVISED MAY 2004

absolute maximum ratings over operating free-air temperature (unless otherwise noted)†

Supply voltage, V_{CC} (see Note 1)	7 V
Input voltage, V_I : '147, '148	5.5 V
'LS147, 'LS148	7 V
Inter-emitter voltage: '148 only (see Note 2)	5.5 V
Package thermal impedance θ_{JA} (see Note 3): D package	73°C/W
N package	67°C/W
NS package	64°C/W
Storage temperature range, T_{Stg}	–65°C to 150°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

- NOTES:
1. Voltage values, except inter-emitter voltage, are with respect to the network ground terminal.
 2. This is the voltage between two emitters of a multiple-emitter transistor. For '148 circuits, this rating applies between any two of the eight data lines, 0 through 7.
 3. The package thermal impedance is calculated in accordance with JESD 51-7.

recommended operating conditions (see Note 4)

	SN54'			SN74'			SN54LS'			SN74LS'			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	MIN	NOM	MAX	MIN	NOM	MAX	
V_{CC} Supply voltage	4.5	5	5.5	4.75	5	5.25	4.5	5	5.5	4.75	5	5.25	V
I_{OH} High-level output current			–800			–800			–400			–400	μA
I_{OL} Low-level output current			16			16			4			8	mA
T_A Operating free-air temperature	–55		125	0		70	–55		125	0		70	°C

NOTE 4: All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.



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SDLS053B – OCTOBER 1976 – REVISED MAY 2004

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER		TEST CONDITIONS†	'147			'148			UNIT
			MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V _{IH}	High-level input voltage		2			2			V
V _{IL}	Low-level input voltage				0.8			0.8	V
V _{IK}	Input clamp voltage	V _{CC} = MIN, I _I = -12 mA			-1.5			-1.5	V
V _{OH}	High-level output voltage	V _{CC} = MIN, V _{IL} = 0.8 V, V _{IH} = 2 V, I _{OH} = -800 μA	2.4	3.3		2.4	3.3		V
V _{OL}	Low-level output voltage	V _{CC} = MIN, V _{IL} = 0.8 V, V _{IH} = 2 V, I _{OL} = 16 mA		0.2	0.4		0.2	0.4	V
I _I	Input current at maximum input voltage	V _{CC} = MIN, V _I = 5.5 V			1			1	mA
I _{IH}	High-level input current	0 input						40	μA
		Any input except 0	V _{CC} = MAX, V _I = 2.4 V			40		80	
I _{IL}	Low-level input current	0 input						-1.6	mA
		Any input except 0	V _{CC} = MAX, V _I = 0.4 V			-1.6		-3.2	
I _{OS}	Short-circuit output current§	V _{CC} = MAX	-35		-85	-35		-85	mA
I _{CC}	Supply current	V _{CC} = MAX (See Note 5)	Condition 1	50	70	40	60		mA
			Condition 2	42	62	35	55		

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ All typical values are at V_{CC} = 5 V, T_A = 25°C.

§ Not more than one output should be shorted at a time.

NOTE 5: For '147, I_{CC} (Condition 1) is measured with input 7 grounded, other inputs and outputs open; I_{CC} (Condition 2) is measured with all inputs and outputs open. For '148, I_{CC} (Condition 1) is measured with inputs 7 and EI grounded, other inputs and outputs open; I_{CC} (Condition 2) is measured with all inputs and outputs open.

SN54147, SN74147 switching characteristics, V_{CC} = 5 V, T_A = 25°C (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	WAVEFORM	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t _{PLH}	Any	Any	In-phase output	C _L = 15 pF, R _L = 400 Ω		9	14	ns
t _{PHL}						7	11	
t _{PLH}	Any	Any	Out-of-phase output			13	19	ns
t _{PHL}						12	19	



SN54147, SN54148, SN54LS147, SN54LS148
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SDLS053B – OCTOBER 1976 – REVISED MAY 2004

SN54148, SN74148 switching characteristics, $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$ (see Figure 1)

PARAMETER†	FROM (INPUT)	TO (OUTPUT)	WAVEFORM	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t _{PLH}	1–7	A0, A1, or A2	In-phase output	C _L = 15 pF, R _L = 400 Ω	10	15	ns	
t _{PHL}								
t _{PLH}	1–7	A0, A1, or A2	Out-of-phase output		12	19	ns	
t _{PHL}								6
t _{PLH}	0–7	EO	Out-of-phase output		14	25	ns	
t _{PHL}								18
t _{PLH}	0–7	GS	In-phase output		14	25	ns	
t _{PHL}								10
t _{PLH}	EI	A0, A1, or A2	In-phase output		10	15	ns	
t _{PHL}								8
t _{PLH}	EI	GS	In-phase output		10	15	ns	
t _{PHL}								10
t _{PLH}	EI	EO	In-phase output		10	15	ns	
t _{PHL}								17

† t_{PLH} = propagation delay time, low-to-high-level output.
t_{PHL} = propagation delay time, high-to-low-level output.

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER		TEST CONDITIONS†	SN54LS'		SN74LS'		UNIT	
			MIN	TYP‡	MAX	MIN		TYP‡
V _{IH}	High-level input voltage		2		2		V	
V _{IL}	Low-level input voltage				0.7	0.8	V	
V _{IK}	Input clamp voltage	V _{CC} = MIN, I _I = -18 mA			-1.5	-1.5	V	
V _{OH}	High-level output voltage	V _{CC} = MIN, V _{IL} = 0.8 V, I _{OH} = -400 μA	2.5	3.4	2.7	3.4	V	
V _{OL}	Low-level output voltage	V _{CC} = MIN, V _{IH} = 2 V, V _{IL} = V _{IL} MAX	I _{OL} = 4 mA		0.25	0.4	0.25	0.4
			I _{OL} = 8 mA				0.35	0.5
I _I	Input current at maximum input voltage	'LS148 inputs 1–7	V _{CC} = MAX, V _I = 7 V		0.2		0.2	
		All other inputs						
I _{IH}	High-level input current	'LS148 inputs 1–7	V _{CC} = MAX, V _I = 2.7 V		40		40	
		All other inputs						
I _{IL}	Low-level input current	'LS148 inputs 1–7	V _{CC} = MAX, V _I = 0.4 V		-0.8		-0.8	
		All other inputs						
I _{OS}	Short-circuit output current§	V _{CC} = MAX	-20	-100	-20	-100	mA	
I _{CC}	Supply current	V _{CC} = MAX (See Note 6)	Condition 1		12	20	12	20
			Condition 2		10	17	10	17

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ All typical values are at V_{CC} = 5 V, T_A = 25°C.

§ Not more than one output should be shorted at a time.

NOTE 6: For 'LS147, I_{CC} (Condition 1) is measured with input 7 grounded, other inputs and outputs open; I_{CC} (Condition 2) is measured with all inputs and outputs open. For 'LS148, I_{CC} (Condition 1) is measured with inputs 7 and EI grounded, other inputs and outputs open; I_{CC} (Condition 2) is measured with all inputs and outputs open.



SN54147, SN54148, SN54LS147, SN54LS148
SN74147, SN74148 (TIM9907), SN74LS147, SN74LS148
10-LINE TO 4-LINE AND 8-LINE TO 3-LINE PRIORITY ENCODERS

SDLS053B – OCTOBER 1976 – REVISED MAY 2004

SN54LS147, SN74LS147 switching characteristics, $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$ (see Figure 2)

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

SN54LS148, SN74LS148 switching characteristics, $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$ (see Figure 2)

PARAMETER†	FROM (INPUT)	TO (OUTPUT)	WAVEFORM	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{PLH}	1–7	A0, A1, or A2	In-phase output	$C_L = 15\text{ pF}$, $R_L = 2\text{ k}\Omega$	14	18	ns	
t_{PHL}					15	25		
t_{PLH}	1–7	A0, A1, or A2	Out-of-phase output		20	36	ns	
t_{PHL}					16	29		
t_{PLH}	0–7	EO	Out-of-phase output		7	18	ns	
t_{PHL}					25	40		
t_{PLH}	0–7	GS	In-phase output		35	55	ns	
t_{PHL}					9	21		
t_{PLH}	EI	A0, A1, or A2	In-phase output		16	25	ns	
t_{PHL}					12	25		
t_{PLH}	EI	GS	In-phase output		12	17	ns	
t_{PHL}					14	36		
t_{PLH}	EI	EO	In-phase output		12	21	ns	
t_{PHL}					23	35		

† t_{PLH} = propagation delay time, low-to-high-level output

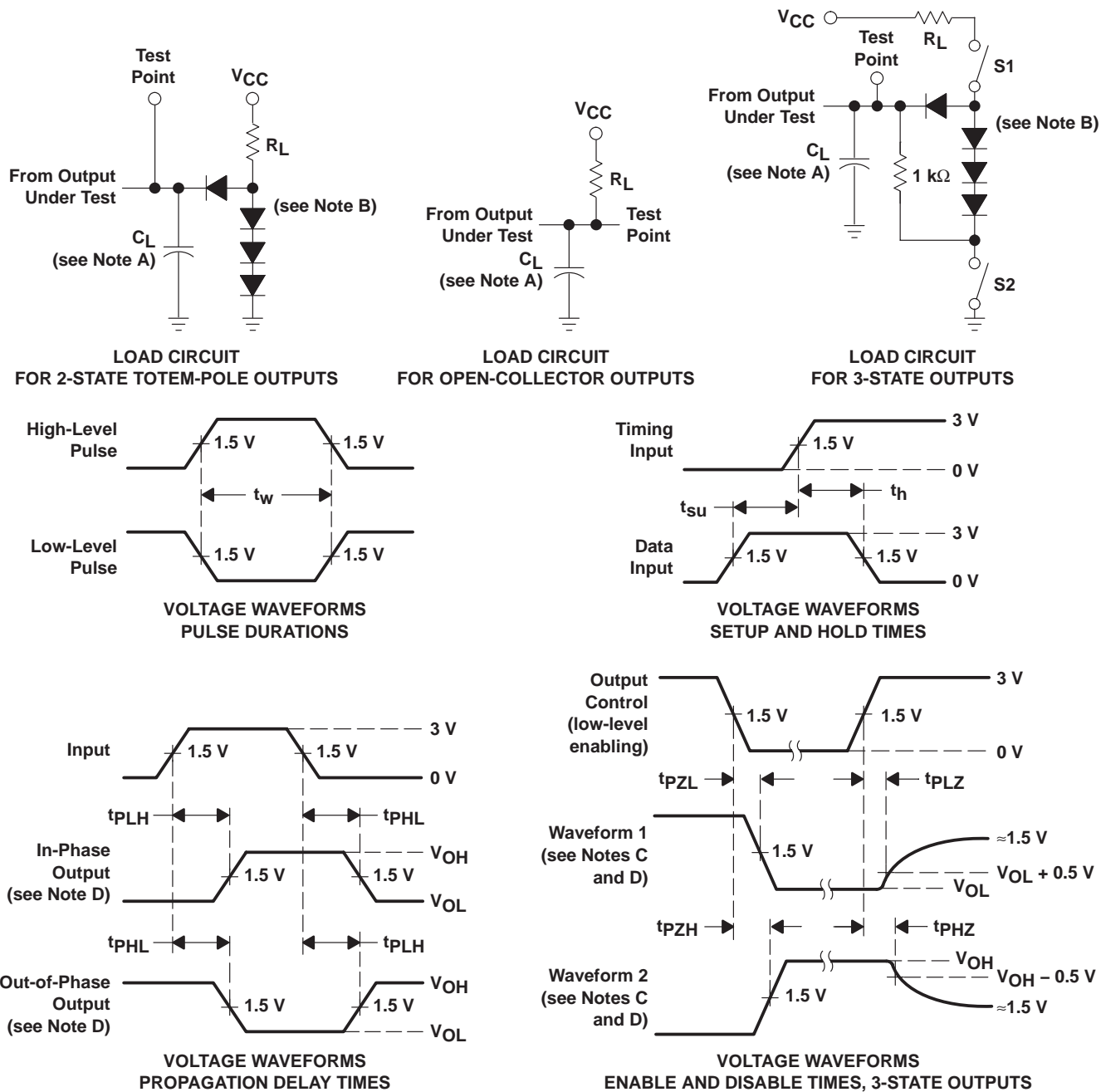
t_{PHL} = propagation delay time, high-to-low-level output



SN54147, SN54148, SN54LS147, SN54LS148
SN74147, SN74148 (TIM9907), SN74LS147, SN74LS148
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SDLS053B – OCTOBER 1976 – REVISED MAY 2004

PARAMETER MEASUREMENT INFORMATION
SERIES 54/74 DEVICES



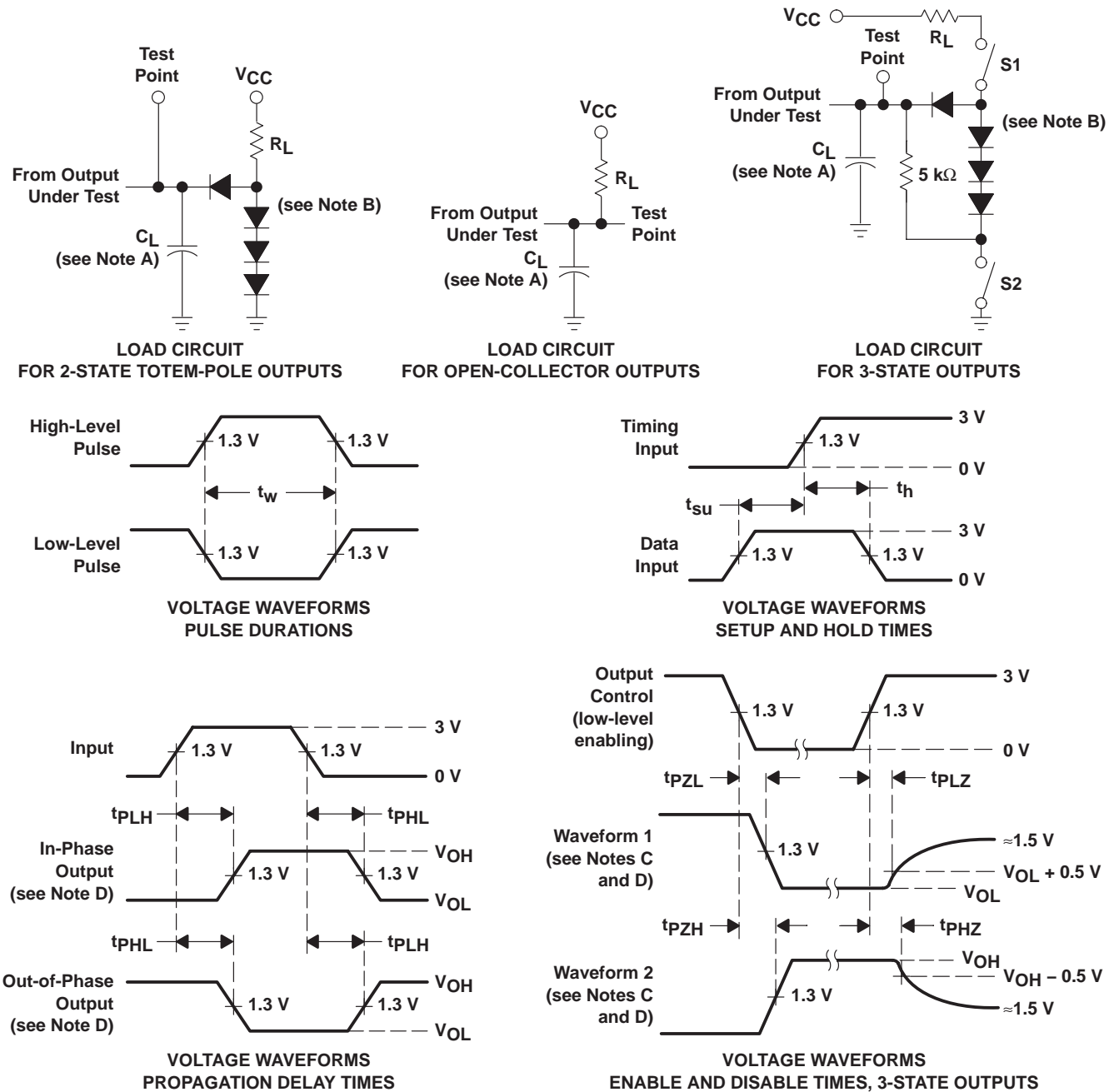
- NOTES:
- A. C_L includes probe and jig capacitance.
 - B. All diodes are 1N3064 or equivalent.
 - C. Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control.
 - D. S1 and S2 are closed for t_{PLH} , t_{PHL} , t_{PHZ} , and t_{PZL} ; S1 is open, and S2 is closed for t_{PZH} ; S1 is closed, and S2 is open for t_{PZL} .
 - E. All input pulses are supplied by generators having the following characteristics: $PRR \leq 1$ MHz, $Z_0 \approx 50 \Omega$; t_r and $t_f \leq 7$ ns for Series 54/74 devices and t_r and $t_f \leq 2.5$ ns for Series 54S/74S devices.
 - F. The outputs are measured one at a time, with one input transition per measurement.

Figure 1. Load Circuits and Voltage Waveforms

**SN54147, SN54148, SN54LS147, SN54LS148
SN74147, SN74148 (TIM9907), SN74LS147, SN74LS148
10-LINE TO 4-LINE AND 8-LINE TO 3-LINE PRIORITY ENCODERS**

SDLS053B – OCTOBER 1976 – REVISED MAY 2004

**PARAMETER MEASUREMENT INFORMATION
SERIES 54LS/74LS DEVICES**



- NOTES: A. C_L includes probe and jig capacitance.
 B. All diodes are 1N3064 or equivalent.
 C. Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control.
 D. S1 and S2 are closed for t_{PLH} , t_{PHL} , t_{PHZ} , and t_{PLZ} ; S1 is open, and S2 is closed for t_{PZH} ; S1 is closed, and S2 is open for t_{PZL} .
 E. Phase relationships between inputs and outputs have been chosen arbitrarily for these examples.
 F. All input pulses are supplied by generators having the following characteristics: $PRR \leq 1$ MHz, $Z_O \approx 50 \Omega$, $t_r \leq 1.5$ ns, $t_f \leq 2.6$ ns.
 G. The outputs are measured one at a time, with one input transition per measurement.

Figure 2. Load Circuits and Voltage Waveforms

**SN54147, SN54148, SN54LS147, SN54LS148
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SDLS053B – OCTOBER 1976 – REVISED MAY 2004

APPLICATION INFORMATION

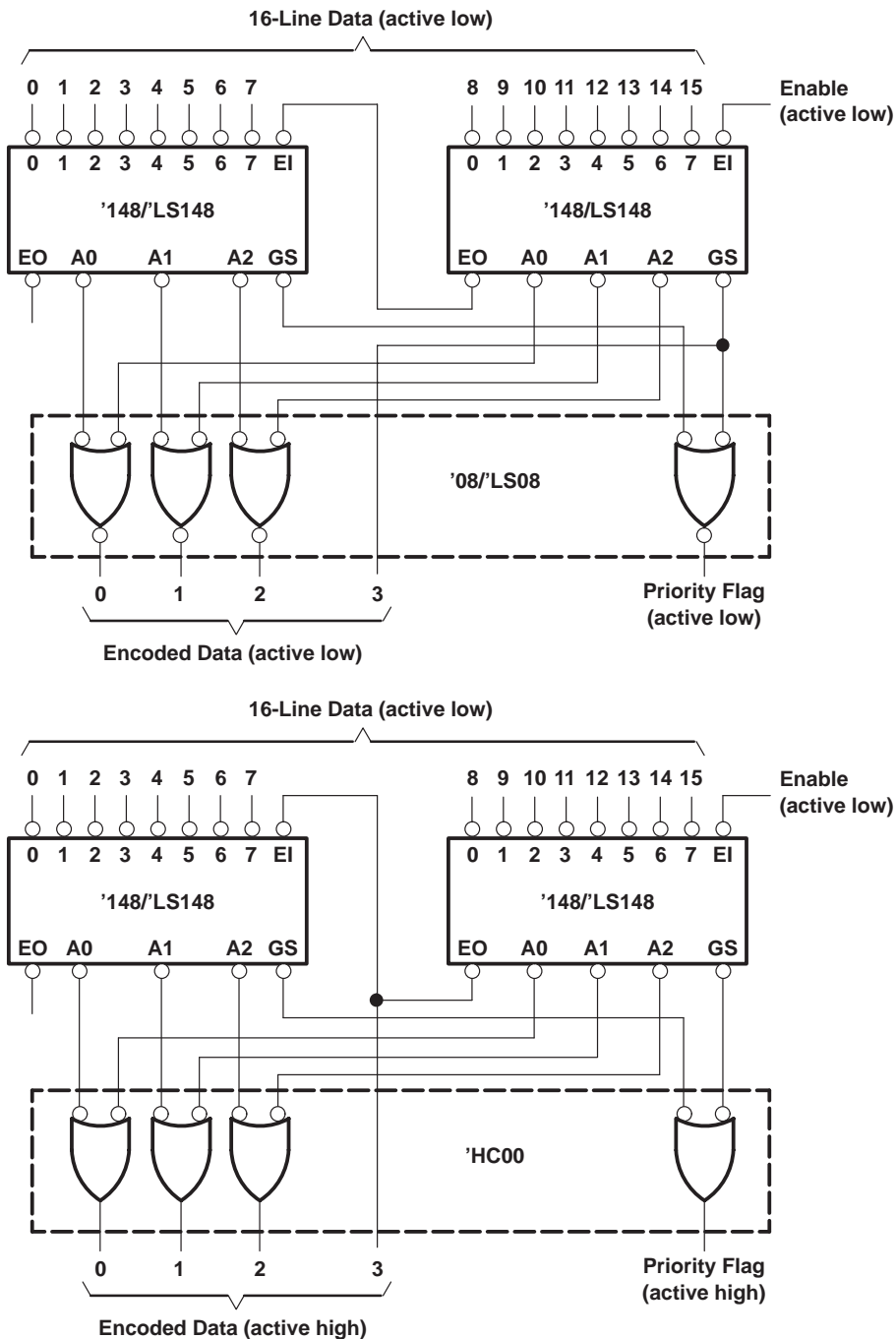


Figure 3. Priority Encoder for 16 Bits

Because the '147/LS147 and '148/LS148 devices are combinational logic circuits, wrong addresses can appear during input transients. Moreover, for the '148/LS148 devices, a change from high to low at EI can cause a transient low on GS when all inputs are high. This must be considered when strobing the outputs.

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/ Ball Finish	MSL Peak Temp ⁽³⁾	Samples (Requires Login)
78027012A	ACTIVE	LCCC	FK	20	1	TBD	Call TI	Call TI	
7802701EA	ACTIVE	CDIP	J	16	1	TBD	Call TI	Call TI	
7802701FA	ACTIVE	CFP	W	16	1	TBD	Call TI	Call TI	
JM38510/36001B2A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	
JM38510/36001BEA	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	
JM38510/36001BFA	ACTIVE	CFP	W	16	1	TBD	A42	N / A for Pkg Type	
M38510/36001B2A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	
M38510/36001BEA	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	
M38510/36001BFA	ACTIVE	CFP	W	16	1	TBD	A42	N / A for Pkg Type	
SN54148J	OBSOLETE	CDIP	J	16		TBD	Call TI	Call TI	
SN54LS148J	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	
SN74147N	OBSOLETE	PDIP	N	16		TBD	Call TI	Call TI	
SN74148J	OBSOLETE	CDIP	J	16		TBD	Call TI	Call TI	
SN74148N	OBSOLETE	PDIP	N	16		TBD	Call TI	Call TI	
SN74148N3	OBSOLETE	PDIP	N	16		TBD	Call TI	Call TI	
SN74LS147DR	OBSOLETE	SOIC	D	16		TBD	Call TI	Call TI	
SN74LS147N	OBSOLETE	PDIP	N	16		TBD	Call TI	Call TI	
SN74LS148D	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74LS148DE4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74LS148DG4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74LS148DR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74LS148DRE4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74LS148DRG4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74LS148J	OBSOLETE	CDIP	J	16		TBD	Call TI	Call TI	
SN74LS148N	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/ Ball Finish	MSL Peak Temp ⁽³⁾	Samples (Requires Login)
SN74LS148N3	OBSOLETE	PDIP	N	16		TBD	Call TI	Call TI	
SN74LS148NE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	
SN74LS148NSR	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74LS148NSRE4	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74LS148NSRG4	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SNJ54148J	OBSOLETE	CDIP	J	16		TBD	Call TI	Call TI	
SNJ54148W	OBSOLETE	CFP	W	16		TBD	Call TI	Call TI	
SNJ54LS148FK	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	
SNJ54LS148J	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	
SNJ54LS148W	ACTIVE	CFP	W	16	1	TBD	A42	N / A for Pkg Type	

⁽¹⁾ The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBSOLETE: TI has discontinued the production of the device.

⁽²⁾ Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

TBD: The Pb-Free/Green conversion plan has not been defined.

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

⁽³⁾ MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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OTHER QUALIFIED VERSIONS OF SN54147, SN54148, SN54LS147, SN54LS148, SN74147, SN74148, SN74LS147, SN74LS148 :

● Catalog: [SN74147](#), [SN74148](#), [SN74LS147](#), [SN74LS148](#)

● Military: [SN54147](#), [SN54148](#), [SN54LS147](#), [SN54LS148](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Military - QML certified for Military and Defense Applications

TAPE AND REEL INFORMATION
REEL DIMENSIONS

TAPE DIMENSIONS


A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

TAPE AND REEL INFORMATION

*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74LS148DR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
SN74LS148NSR	SO	NS	16	2000	330.0	16.4	8.2	10.5	2.5	12.0	16.0	Q1

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74LS148DR	SOIC	D	16	2500	333.2	345.9	28.6
SN74LS148NSR	SO	NS	16	2000	367.0	367.0	38.0

J (R-GDIP-T**)

14 LEADS SHOWN

CERAMIC DUAL IN-LINE PACKAGE



DIM \ PINS **	14	16	18	20
A	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC
B MAX	0.785 (19,94)	.840 (21,34)	0.960 (24,38)	1.060 (26,92)
B MIN	—	—	—	—
C MAX	0.300 (7,62)	0.300 (7,62)	0.310 (7,87)	0.300 (7,62)
C MIN	0.245 (6,22)	0.245 (6,22)	0.220 (5,59)	0.245 (6,22)

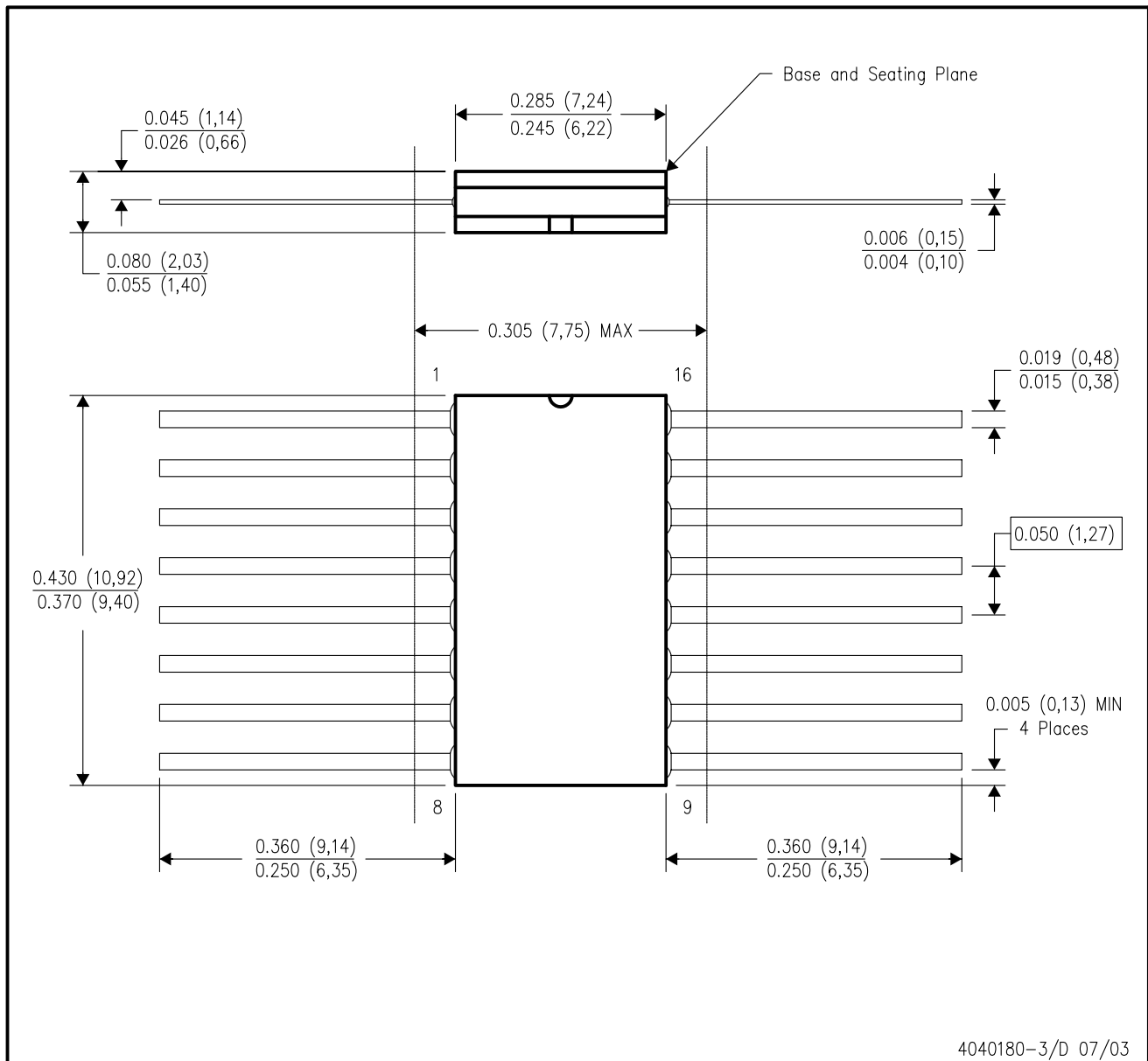


4040083/F 03/03

- NOTES:
- All linear dimensions are in inches (millimeters).
 - This drawing is subject to change without notice.
 - This package is hermetically sealed with a ceramic lid using glass frit.
 - Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
 - Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18 and GDIP1-T20.

W (R-GDFP-F16)

CERAMIC DUAL FLATPACK



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. This package can be hermetically sealed with a ceramic lid using glass frit.
 - D. Index point is provided on cap for terminal identification only.
 - E. Falls within MIL STD 1835 GDFP1-F16 and JEDEC MO-092AC

FK (S-CQCC-N**)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



NO. OF TERMINALS **	A		B	
	MIN	MAX	MIN	MAX
20	0.342 (8,69)	0.358 (9,09)	0.307 (7,80)	0.358 (9,09)
28	0.442 (11,23)	0.458 (11,63)	0.406 (10,31)	0.458 (11,63)
44	0.640 (16,26)	0.660 (16,76)	0.495 (12,58)	0.560 (14,22)
52	0.740 (18,78)	0.761 (19,32)	0.495 (12,58)	0.560 (14,22)
68	0.938 (23,83)	0.962 (24,43)	0.850 (21,6)	0.858 (21,8)
84	1.141 (28,99)	1.165 (29,59)	1.047 (26,6)	1.063 (27,0)



4040140/D 01/11

- NOTES:
- All linear dimensions are in inches (millimeters).
 - This drawing is subject to change without notice.
 - This package can be hermetically sealed with a metal lid.
 - Falls within JEDEC MS-004

N (R-PDIP-T**)

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN

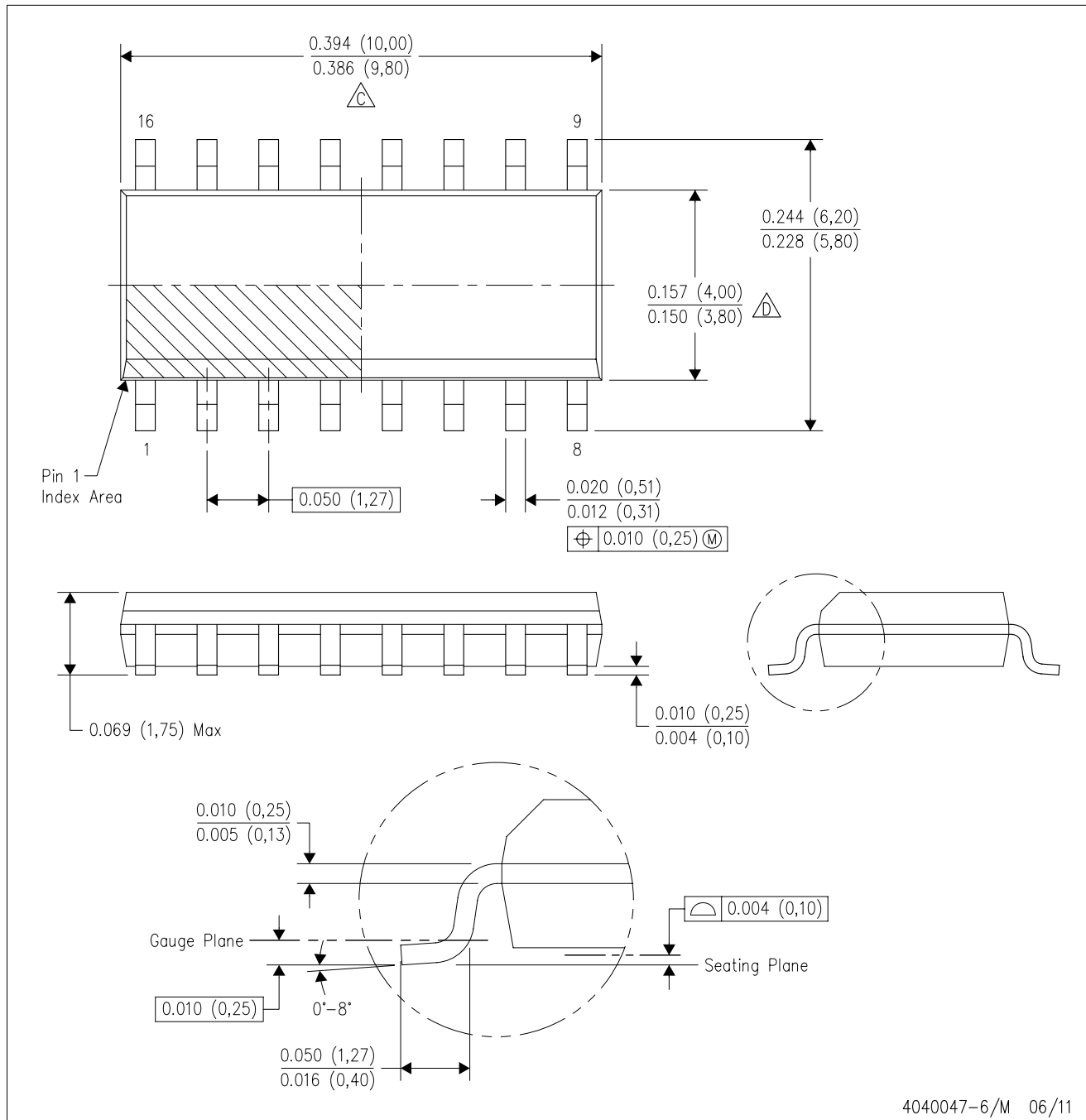


4040049/E 12/2002

- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
 - The 20 pin end lead shoulder width is a vendor option, either half or full width.

D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
 - D. Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
 - E. Reference JEDEC MS-012 variation AC.

D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Publication IPC-7351 is recommended for alternate designs.
 - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
 - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

MECHANICAL DATA

NS (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



- NOTES:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

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