SDLS161 - OCTOBER 1976 - REVISED MARCH 1988

- 3-State Outputs Drive Bus Lines Directly
- Encodes 8 Data Lines to 3-Line Binary (Octal)
- Applications Include:
   N-Bit Encoding
   Code Converters and Generators
- Typical Data Delay . . . 15 ns
- Typical Power Dissipation . . . 60 mW

### description

These TTL encoders feature priority decoding of the inputs to ensure that only the highest-order data line is encoded. The 'LS348 circuits encode eight data lines to three-line (4-2-1) binary (octal). Cascading circuitry (enable input E1 and enable output E0) has been provided to allow octal expansion. Outputs A0, A1, and A2 are implemented in three-state logic for easy expansion up to 64 lines without the need for external circuitry. See Typical Application Data.

### **FUNCTION TABLE**

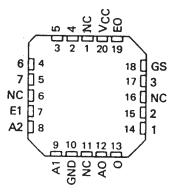
	INPUTS									OL	JTPU	TS	
EI	0	1	2	3	4	5	6	7	A2	A1	A0	GS	EO
Н	Х	Х	Χ	Х	Χ	X	X	Χ	Z	Z	Z	Н	Н
L	Н	Н	Н	Н	Н	Н	Н	Н	z	Z	Z	н	L
L	Х	Χ	Х	Х	Х	Χ	Х	L	L	L	L	L	н
L	Х	Х	X	Х	Х	Х	L	Н	L	L	Н	L	н
L	Х	Х	Χ	X	Х	L	Н	Н	L	Н	L	L	н
L	Х	Х	Χ	Х	L	Н	Н	Н	L	Н	Н	L	н
L	Ý	Х	Х	L	Н	Н	Н	Н	н	L	L	L	н
L	Х	Х	L	Н	Н	Н	Н	Н	н	L	н	L	н
L	X	L	Н	H	Н	Н	Н	Н	н	Н	L	L	н
L	L	Н	Н	Н	H	Н	Н	Н	Н	Н	Н	L	н

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

SN54LS348 . . . J OR W PACKAGE SN74LS348 . . . D OR N PACKAGE (TOP VIEW)

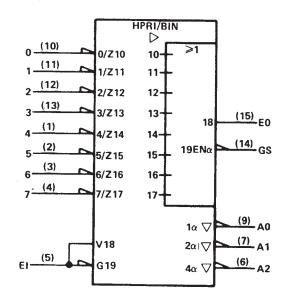
4 🛮 1	U <sub>16</sub> V <sub>CC</sub>
5 🛮 2	15 EO
6 □3	14 🛮 GS
7 🛮 4	13 3
E1 ∏5	12 2
A2 [ 6	11 🛮 1
A1 🔲 7	10 🛮 0
GND 🛮 8	9 AO

# SN54LS348 . . . FK PACKAGE (TOP VIEW)



NC - No internal connection

## logic symbol<sup>†</sup>



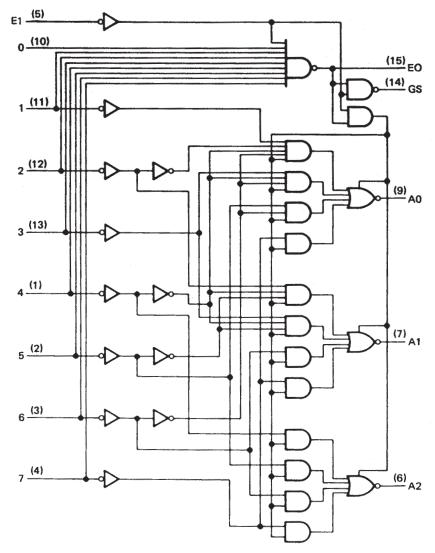
<sup>&</sup>lt;sup>†</sup>This symbol is in accordance with ANSI/IEEE Std. 91-1984 and IEC Publication 617-12.

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



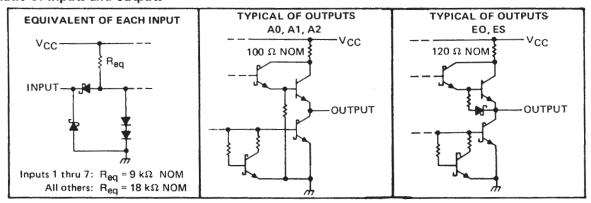
Z = high-impedance state

### logic diagram (positive logic)



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

### schematic of inputs and outputs





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

Supply voltage, VCC (see Note 1)	
Operating free-air temperature range	SN54LS348
	SN74LS348
Storage temperature range	

NOTE 1: Voltage values are with respect to network ground terminal.

### recommended operating conditions

		SN54LS348			SN74LS348			
		MIN	NOM	MAX	MIN	NOM	MAX	UNIT
Supply voltage, V <sub>CC</sub>		4.5	5	5.5	4.75	5	5,25	V
High-level output current, IOH	A0, A1, A2			-1			-2.6	mA
Triginever output current, TOH	EO, GS			-400			-400	μΑ
Low-level output current, IOI	A0, A1, A2			12			24	mA
- Low-level output current, 10[	EO, GS			4			8	mA
Operating free-air temperature, TA		-55		125	0		70	°C

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

	PARAMETER	TEST CON	SN	154LS3	148	SN74LS348					
	TARAMETER		TEST CON	MIN	TYP‡	MAX	MIN	TYP‡	MAX	UNIT	
VIH	High-level input voltage				2			2			V
VIL	Low-level input voltage					**	0.7			0.8	V
VIK	Input clamp voltage		V <sub>CC</sub> = MIN,	I <sub>1</sub> = -18 mA			-1.5			-1.5	V
	High-level	A0, A1, A2	V <sub>CC</sub> = MIN,	I <sub>OH</sub> = -1 mA	2.4	3.1					
$v_{OH}$	output voltage	A0, A1, A2	V <sub>!H</sub> = 2 V,	I <sub>OH</sub> = -2.6 mA				2.4	3,1		V
	Output vortage	EO, GS	VIL = VILmax	$I_{OH} = -400 \mu A$	2.5	3.4		2.7	3.4		
		A0, A1, A2	V <sub>CC</sub> = MIN,	I <sub>OL</sub> = 12 mA		0.25	0.4		0.25	0.4	
VOL	Low-level	A0, A1, A2	V <sub>IH</sub> = 2 V,	OL = 24 mA					0,35	0.5	v
VOL	Output voltage	EO, GS	VIL = VILmax	<sup>1</sup> OL = 4 mA		0.25	0.4		0.25 0.4	0.4	, v
		20, 43	VIL - VILINAX	I <sub>OL</sub> = 8 mA					0.35	0.5	
loz	Off-State (high-impedance	A0, A1, A2	V <sub>CC</sub> = MAX,	V <sub>O</sub> = 2.7 V		········	20			20	_
.02	state) output current	A0, A1, A2	V <sub>IH</sub> = 2 V	V <sub>O</sub> = 0.4 V			-20			-20	μΑ
11	Input current at maximum	Inputs 1 thru 7	V 144.V	V 7.V			0.2			0,2	_
.1	input voltage	All other inputs	V <sub>CC</sub> = MAX,	V  = / V			0.1			0.1	mA
Ιн	High-level input current	Inputs 1 thru 7	V MAY	V 27V		40				40	
'1H	riigii-ievei triput current	All other inputs	V <sub>CC</sub> = MAX,	V  = 2.7 V			20 20		μA		
111	Low-level input current	Inputs 1 thru 7	V NAAY	V = 0 4 V		-0.8				-0.8	
'1L	-ow-level input current	All other inputs	V <sub>CC</sub> = MAX,	V   = 0.4 V			-0.4 -0.4			mA	
los	Short-circuit output current §	Outputs A0, A1, A2	V		-30		-130	-30		-130	<u> </u>
.02	onore encure output current o	Outputs EO, GS	V <sub>CC</sub> = MAX		-20		-100	-20		-100	mA
Icc	Supply current		V <sub>CC</sub> = MAX,	Condition 1		13	25		13	25	^
.00	capping carroine		See Note 2	Condition 2		12	23		12	23	mA

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

NOTE 2: ICC (condition 1) is measured with inputs 7 and EI grounded, other inputs and outputs open. ICC (condition 2) is measured with all inputs and outputs open.



<sup>\$</sup> All typical values are at  $V_{CC} = 5 \text{ V}$ ,  $T_A = 25^{\circ} \text{C}$ .

<sup>§</sup> Not more than one output should be shorted at a time.

# SN54LS348, SN74LS348 (TIM9908) 8-LINE TO 3-LINE PRIORITY ENCODERS WITH 3-STATE OUTPUTS

SDLS161 - OCTOBER 1976 - REVISED MARCH 1988

## switching characteristics, $V_{CC} = 5 \text{ V}$ , $T_A = 25^{\circ} \text{ C}$

PARAMETER <sup>†</sup>	FROM (INPUT)	TO (OUTPUT)	WAVEFORM	TEST CONDITIONS	MIN	TYP	MAX	UNIT
ФLН	1 thru 7	A0, A1, or A2	In-phase		111	11	17	ns
tPHL.	1 11114 /	A0, A1, 01 A2	output	C. = 45 = 5		20	30	เปร
ФLН	1 thru 7	A0, A1, or A2	Out-of-phase	C <sub>L</sub> ≈ 45 pF,		23	35	ns
<b>tPHL</b>	1 thru /	AU, A1, 01 A2	output	R <sub>L</sub> = 667 Ω, See Note 3		23	35	113
ФZН	Et	A0, A1, or A2		See 14016 2		25 24	39	ns
ΨZL	] '	70, 71, 01 72					41	] ""
<b>tPLH</b>	0 thru 7	EO	Out-of-phase			11	18	ns
<b>tPHL</b>	O and /		output			26	40	
<b>tPLH</b>	0 thru 7	GS	In-phase	Cլ = 15 pF		38	55	ns
tPHL	O and /		output	$R_{L} = 2 k\Omega$ ,		9	21	1 ""
<b>tPLH</b>	EI	GS	In-phase	See Note 3		11	17	
<b>tPHL</b>	1 -	43	output	See Note 3		14	36	ns
ФLН	EI	EO	In-phase			17	26	
tPHL	1 "		output	:		25	40	ns
<sup>t</sup> PHZ	EI	A0, A1, or A2		CL = 5 pF		18	27	
<b>tPLZ</b>	] -'	70, 71, 01 72		R <sub>L</sub> = 667 Ω		23	35	ns

 $<sup>^{\</sup>dagger}$  tpLH = propagation delay time, low-to-high-level output

tpzH = output enable time to high level

tpzL = output enable time to low level

tpHZ = output disable time from high level

tpLZ = output disable time from low level

NOTE 3: Load circuits and voltage waveforms are shown in Section 1.

## TYPICAL APPLICATION DATA

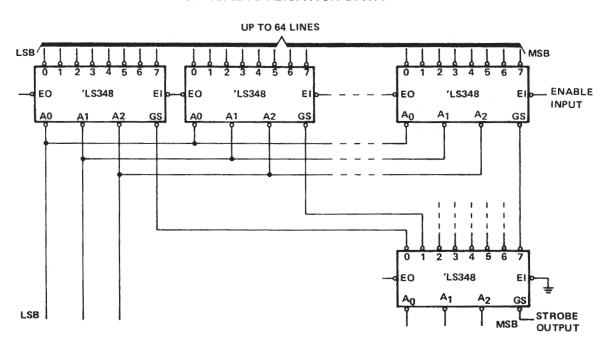


FIGURE 1-PRIORITY ENCODER WITH UP TO 64 INPUTS.



tpHL = propagation delay time, high-to-low-level output





10-Jun-2014

### **PACKAGING INFORMATION**

Orderable Device	Status	Package Type	Package	Pins	Package	Eco Plan	Lead/Ball Finish	MSL Peak Temp	Op Temp (°C)	Device Marking	Samples
	(1)		Drawing		Qty	(2)	(6)	(3)		(4/5)	
JM38510/36002B2A	OBSOLETE	LCCC	FK	20		TBD	Call TI	Call TI	-55 to 125		
JM38510/36002BEA	OBSOLETE	CDIP	J	16		TBD	Call TI	Call TI	-55 to 125		
SN54LS348J	OBSOLETE	CDIP	J	16		TBD	Call TI	Call TI	-55 to 125		
SN74LS348D	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	LS348	Samples
SN74LS348DG4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	LS348	Samples
SN74LS348N	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	0 to 70	SN74LS348N	Samples
SN74LS348N3	OBSOLETE	PDIP	N	16		TBD	Call TI	Call TI	0 to 70		
SNJ54LS348FK	OBSOLETE	LCCC	FK	20		TBD	Call TI	Call TI	-55 to 125		
SNJ54LS348J	OBSOLETE	CDIP	J	16		TBD	Call TI	Call TI	-55 to 125		
SNJ54LS348W	OBSOLETE	CFP	W	20		TBD	Call TI	Call TI	-55 to 125		

<sup>(1)</sup> 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)

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

<sup>(4)</sup> There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.



## PACKAGE OPTION ADDENDUM

10-Jun-2014

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

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#### OTHER QUALIFIED VERSIONS OF SN54LS348, SN74LS348:

Catalog: SN74LS348

Military: SN54LS348

NOTE: Qualified Version Definitions:

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

## 14 LEADS SHOWN



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

# W (R-GDFP-F20)

# CERAMIC DUAL FLATPACK



- A. All linear dimensions are in inches (millimeters).
- 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 GDFP2—F20



# FK (S-CQCC-N\*\*)

# LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



- 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 metal lid.
- D. Falls within JEDEC MS-004



# N (R-PDIP-T\*\*)

# PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



- 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-PDS0-G16)

## PLASTIC SMALL OUTLINE



- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- 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.
- 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



- 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.



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