

SN54LS445, SN74LS445 BCD-TO-DECIMAL DECODERS/DRIVERS

SDLS177 - NOVEMBER 1977 - REVISED MARCH 1988

FOR USE AS LAMP, RELAY, OR MOS DRIVERS

- Low-Voltage Version of SN54LS145/
SN74LS145
- Full Decoding of Input Logic
- SN74LS445 Has 80-mA Sink-Current
Capability
- All Outputs Are Off for Invalid BCD
Input Conditions
- Low Power Dissipation . . . 35 mW
Typical

logic

FUNCTION TABLE

NO.	INPUTS				OUTPUTS										
	D	C	B	A	0	1	2	3	4	5	6	7	8	9	
0	L	L	L	L	L	H	H	H	H	H	H	H	H	H	H
1	L	L	L	H	H	L	H	H	H	H	H	H	H	H	H
2	L	L	H	L	H	H	L	H	H	H	H	H	H	H	H
3	L	L	H	H	H	H	H	L	H	H	H	H	H	H	H
4	L	H	L	L	H	H	H	H	L	H	H	H	H	H	H
5	L	H	L	H	H	H	H	H	H	L	H	H	H	H	H
6	L	H	H	L	H	H	H	H	H	H	L	H	H	H	H
7	L	H	H	H	H	H	H	H	H	H	H	L	H	H	H
8	H	L	L	L	H	H	H	H	H	H	H	H	L	H	H
9	H	L	L	H	H	H	H	H	H	H	H	H	H	L	H
INVALID	H	L	H	L	H	H	H	H	H	H	H	H	H	H	H
	H	L	H	H	H	H	H	H	H	H	H	H	H	H	H
	H	H	L	L	H	H	H	H	H	H	H	H	H	H	H
	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H
	H	H	H	L	H	H	H	H	H	H	H	H	H	H	H

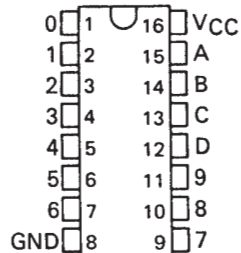
H = high level (off), L = low level (on)

description

These monolithic BCD-to-decimal decoder/drivers consist of eight inverters and ten four-input NAND gates. The inverters are connected in pairs to make BCD input data available for decoding by the NAND gates. Full decoding of valid BCD input logic ensures that all outputs remain off for all invalid binary input conditions. These decoders feature high-performance, n-p-n output transistors designed for use as indicator/relay drivers or as open-collector logic-circuit drivers. Each of the output transistors will sink up to 80 milliamperes of current. Each input is one Series 54LS/74LS standard load. Inputs and outputs are entirely compatible for use with TTL logic circuits, and the outputs are compatible for interfacing with most MOS integrated circuits. Power dissipation is typically 35 milliwatts.

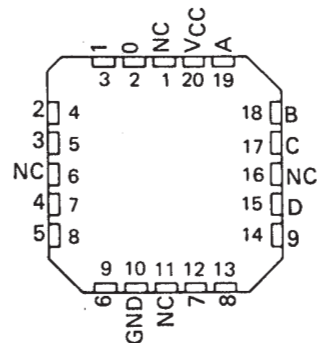
SN54LS445 . . . J PACKAGE
SN74LS445 . . . D OR N PACKAGE

(TOP VIEW)



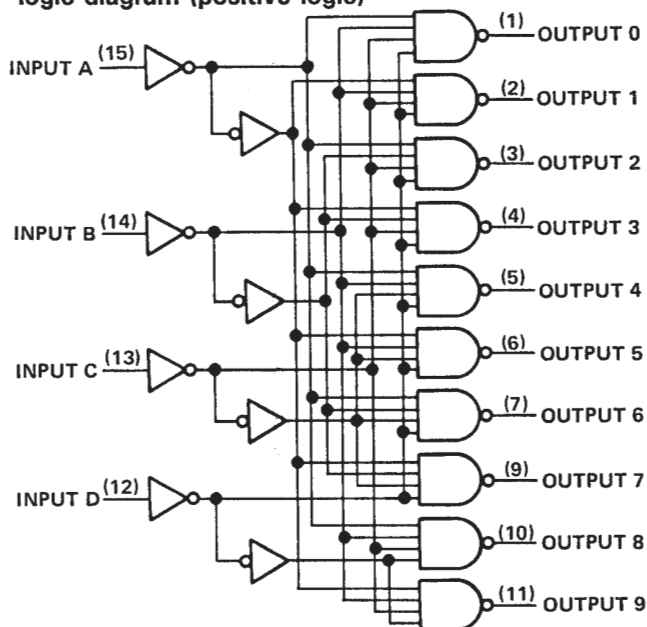
SN54LS445 . . . FK PACKAGE

(TOP VIEW)



NC - No internal connection

logic diagram (positive logic)



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

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

TEXAS
INSTRUMENTS

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

Supply voltage, V_{CC} (see Note 1)	7 V
Input voltage	7 V
Operating free-air temperature range: SN54LS445	-55°C to 125°C
SN74LS445	0°C to 70°C
Storage temperature range	-65°C to 150°C

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

recommended operating conditions

	SN54LS445			SN74LS445			UNIT	
	MIN	NOM	MAX	MIN	NOM	MAX		
Supply voltage, V_{CC}	4.5	5	5.5	4.75	5	5.25	V	
Off-state output voltage, $V_{O(off)}$	7			7			V	
Operating free-air temperature, T_A	-55			0			70	°C

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

PARAMETER	TEST CONDITIONS†	SN54LS445		SN74LS445		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	$V_{CC} = \text{MIN}, I_I = -18 \text{ mA}$	-1.5		-1.5		V	
$I_{O(off)}$ Off-state output current	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = V_{IL \text{ max}}, V_{OH} = 7 \text{ V}$	250		250		μA	
$V_{O(on)}$ On-state output voltage	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = V_{IL \text{ max}}$	$I_{OL} = 12 \text{ mA}$	0.25	0.4	0.25	0.4	V
		$I_{OL} = 24 \text{ mA}$			0.35	0.5	
		$I_{OL} = 80 \text{ mA}$			2.3	3	
I_I Input current at maximum input voltage	$V_{CC} = \text{MAX}, V_I = 7 \text{ V}$	0.1		0.1		mA	
I_{IH} High-level input current	$V_{CC} = \text{MAX}, V_I = 2.7 \text{ V}$	20		20		μA	
I_{IL} Low-level input current	$V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$	-0.4		-0.4		mA	
I_{CC} Supply current	$V_{CC} = \text{MAX},$ See Note 2	7	13	7	13	mA	

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

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

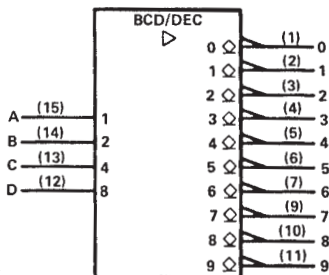
NOTE 2: I_{CC} is measured with all inputs grounded and outputs open.

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

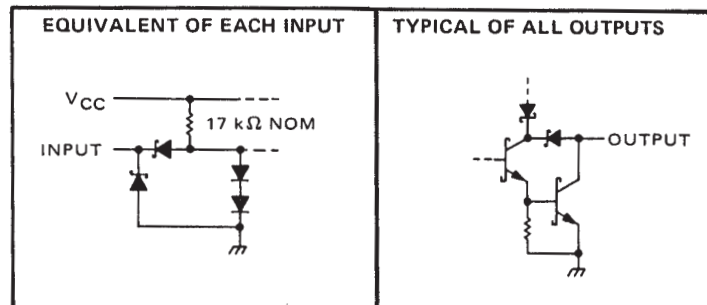
PARAMETER	TEST CONDITIONS	MIN	MAX	UNIT
t_{PLH} Propagation delay time, low-to-high-level output	$C_L = 45 \text{ pF}, R_L = 665 \Omega,$ See Note 3	50		ns
t_{PHL} Propagation delay time, high-to-low-level output		50		ns

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

logic symbol†



schematic of inputs and outputs



†This symbol is in accordance with ANSI/IEEE Std. 91-1984 and IEC Publication 617-12.

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

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
SN74LS445D	OBSOLETE	SOIC	D	16		TBD	Call TI	Call TI
SN74LS445N	OBSOLETE	PDIP	N	16		TBD	Call TI	Call TI

⁽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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