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Texas Instruments
SN74LS247D

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Datasheet of SN74LS247D - IC BCD TO 7-SEG DECODER 16-SOIC

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SDLS083

SN54246, SN54247, SN54LS247, SN54LS248 SN74246, SN74247, SN74LS247, SN74LS248 BCD-TO-SEVEN-SEGMENT DECODERS/DRIVERS

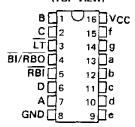
MARCH 1974 - REVISED MARCH 1988

'246, '247, 'LS247 feature 'LS248 feature

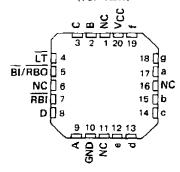
- Open-Collector Outputs Drive Indicators Directly
- Lamp-Test Provision
- Leading/Trailing Zero Suppression
- Internal Pull-Ups Eliminate Need for External Resistors
- Lamp-Test Provision
- Leading/Trailing Zero Suppression
- All Circuit Types Feature Lamp Intensity Modulation Capability

		DRIVER O	UTPUTS		TYPICAL	
TYPE	ACTIVE LEVEL	OUTPUT CONFIGURATION	SINK CURRENT	MAX VOLTAGE	POWER DISSIPATION	PACKAGES
SN54246	low	open-collector	40 mA	30 V	320 mW	J,W
SN54247	low	open-collector	40 mA	15 V	320 mW	W,L
SN54LS247	low	open-collector	12 mA	15 V	35 mW	J,W
SN54LS248	high	2-kΩ pull-up	2 mA	5.6 V	125 mW	J,W
SN74246	low	open-collector	40 mA	30 V	320 mW	J,N
SN74247	low	open-collector	40 mA	15 ∨	320 mW	J,N
SN74LS247	low	open-collector	24 mA	15 V	35 mW	J,N
SN74LS248	high	2-kΩ pull-up	6 mA	5.5 V	125 mW	N,L

SN54246, SN54247 . . . J PACKAGE
SN54LS247 THRU SN54LS248 . . . J OR W PACKAGE
SN74246, SN74247 . . . N PACKAGE
SN74LS247, SN74LS248 . . . D OR N PACKAGE
(TOP VIEW)



SN54LS247, SN54LS248 . . . FK PACKAGE (TOP VIEW)



NC - No internal connection



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SN54246, SN54247, SN54LS247, SN54LS248 SN74246, SN74247, SN74LS247, SN74LS248 BCD-TO-SEVEN-SEGMENT DECODERS/DRIVERS

#### description

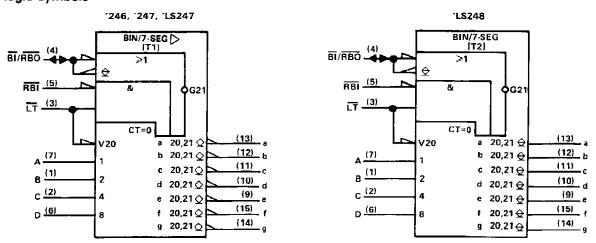
The '246 and '247 are electrically and functionally identical to the SN5446A/SN7446A, and SN5447A/SN7447A respectively, and have the same pin assignments as their equivalents. The 'LS247 and 'LS248 are electrically and functionally identical to the SN54LS47/SN74LS47 and SN54LS48/SN74LS48, respectively, and have the same pin assignments as their equivalents. They can be used interchangeably in present or future designs to offer designers a choice between two indicator fonts. The '46A, '47A, 'LS47, and 'LS48 compose the  $\Box$  and the without tails and the '246, '247, 'LS247, and 'LS248 compose the  $\Box$  and the  $\Box$  with tails. Composition of all other characters, including display patterns for BCD inputs above nine, is identical. The '246, '247, and 'LS247 feature active-low outputs designed for driving indicators directly, and the 'LS248 features active-high outputs for driving lamp buffers. All of the circuits have full ripple-blanking input/output controls and a lamp test input. Segment identification and resultant displays are shown below. Display patterns for BCD input counts above 9 are unique symbols to authenticate input conditions.

All of these circuits incorporate automatic leading and/or trailing-edge zero-blanking control ( $\overline{RBI}$  and  $\overline{RBO}$ ). Lamp test ( $\overline{LT}$ ) of these types may be performed at any time when the  $\overline{BI}/\overline{RBO}$  node is at a high level. All types contain an overriding blanking input (BI) which can be used to control the lamp intensity by pulsing or to inhibit the outputs. Inputs and outputs are entirely compatible for use with TTL logic outputs.

Series 54 and Series 54LS devices are characterized for operation over the full military temperature range of -55°C to 125°C; Series 74 and Series 74LS devices are characterized for operation from 0°C to 70°C.



#### logic symbols†



<sup>†</sup>These symbols are in accordance with ANSI/IEEE Std. 91-1984 and IEC Publication 617-12. Pin numbers shown are for D, J, N, and W packages.





Datasheet of SN74LS247D - IC BCD TO 7-SEG DECODER 16-SOIC

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SN54246, SN54247, SN54LS247, SN54LS248 SN74246, SN74247, SN74LS247, SN74LS248 **BCD-TO-SEVEN-SEGMENT DECODERS/DRIVERS** 

#### '246, '247, 'LS247 FUNCTION TABLE (T1)

DECIMAL OR	INPUTS									o	UTPU	rs			NOTE
FUNCTION	LT	RBI	D	С	В	A	BI/RBO†	а	ь	С	d	e	f	9	]
0	Н	Н	L	L	L.	L	Н	ON	ON	ON	ON	ON	ON	OFF	
1	н	х	L	L	L	н	н	OFF	ON	ON	OFF	OFF	OFF	OFF	
2	н	×	L	L.	н	L	н	ON	ON	OFF	ON	ON	OFF	ON	
3	н	Х	L	L	H	Н	H	ON	ON	ON	ON	OFF	OFF	ON	
4	Н	х	L	Н	L	L	н	OFF	ON	QN	OFF	OFF	ON	ON	
5	Н	×	L	н	L	н	н	ON	OFF	ON	ON	OFF	ON	ON	
6	Н	х	L	Н	H	L	н	ON	OFF	ON	ON	QN	ON	ON	
7	н	х	L	Н	H	Н	н	ON	ON	ON	OFF	OFF	OFF	OFF	
8	н	х	Н	L	L	L	Н	ON	ON	ON	ON	ON	ON	ON	1
9	н	x	Н	L	L	н	н	ON	ON	ON	ON	OFF	ON	ON	
10	н	X	Н	L	Н	L	н	OFF	OFF	OFF	ON	ON	OFF	ON	
11	Н	х	Н	L	н	н	н	OFF	OFF	ON	ON	OFF	OFF	ON	
12	Н	X	Н	Н	L	L.	н	OFF	ON	OFF	OFF	OFF	ON	ON	
13	н	х	Н	Н	L	Н	н	ON	OFF	OFF	ON	OFF	ON	ON	
14	н	x	н	н	н	L	н	OFF	OFF	OFF	ON	ON	ON	ON	
15	Н	х	Н	H	Н	Н	н	OFF	OFF	OFF	OFF	OFF	OFF	OFF	
81	×	×	Х	х	×	Х	L	OFF	OFF	OFF	OFF	OFF	OFF	OFF	2
RBI	H	L	L	L	L	L	Ł	OFF	OFF	OFF	OFF	OFF	OFF	OFF	3
ĒŦ	L	×	×	X	×	×	н	ON	ON	ON	ON	ON	ON	ON	4

#### **'LS248 FUNCTION TABLE (T2)**

	_							_							
DECIMAL OR			INP	UTS			BI/RBO†			0	UTPU	TS			NOTE
FUNCTION	LT	RBI	ם	С	8	Д		a	ь	c	d	•	f	g	
0	Н	H	L	L	L	L	Н	Н	Н	Н	Н	Н	Н	Ĺ	
1	Н	×	L	L	L	Н	н	L.	H	H	L	L	Ł	L	
2	Н	×	L	L	Н	L	н	н	Н	L	Н	Н	L	Н	
3	Н	Х	L	L	Н	_ H	н	Н	Н	H	Н	L	L	H	
4	н	х	٦	Н	L	r	н	_	H	Н	L	٦	Н	Н	
5	Н	Х	L	Н	L	H	н	н	L	Н	Н	L	Н	Н	l
6	н	×	L	Н	н	L	н	н	L	Н	Н	Н	Н	H	
7	H	х	L	Н	Н	н	н	H	H	Н	L	L	L	L	,
8	H	Х	Н	L	L	L	Н	H	Н	Н	Н	H	Н	H	i - I
9	н	×	H	L	L	Н	н	Н	H	H	H	L	н	н	
10	Н	X	Н	L	Н	L	Н	Ł	L	L	Н	Н	L	Н	
11	Н	Х	Н	L	Н	Н	H	L	L	Н	н	L	L	H	}
12	Н	Х	H	Н	L	L	Н	L	Н	L	L	L	Н	Н	
13	Н	Х	Н	Н	L	Н	н	н	L	L	Н	L	Н	н	1
14	н	х	Н	Н	Н	L	н	L	L	L	Н	Н	Н	н	I
15	H	×	H	Н	Н	н	н	L	L	L	L	L	L	L	
<u>BI</u>	Х	×	Х	Х	х	X	L	L	L	L	L	L	L	Ļ	2
RBI	н	L	L	L	L	L	L	Ł	L	L	L	L	L	ᆫ	3
LT	L	Х	Х	Х	×	X.	н	Н	H	Н	H	н	Н	н	4

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

  NOTES: 1. The blanking input (EI) must be open or held at a high logic level when output functions 0 through 15 are desired. The ripple-blanking input (RBI) must be open or high if blanking of a decimal zero is not desired.
  - 2. When a low logic level is applied directly to the blanking input (BI), all segment outputs are low regardless of the level of any
  - When ripple-blanking input (RBI) and Inputs A, B, C, and D are at a low level with the lamp test input high, all segment outputs go low and the ripple-blanking output (RBO) goes to a low level (response condition).
     When the blanking input/ripple-blanking output (BI/RBO) is open or held high and a low is applied to the lamp-test input, all
  - segment outputs are high.
- †BI/RBO is wire-AND logic serving as blanking input (BI) and/or ripple-blanking output (RBO).





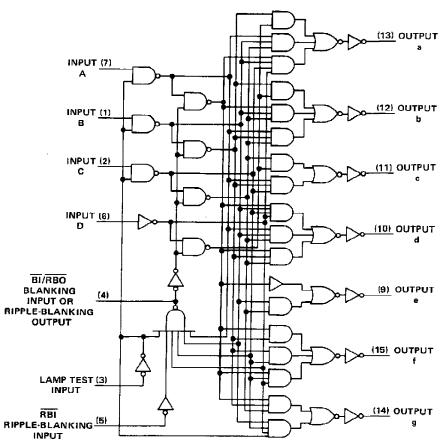
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### SN54246, SN54247, SN54LS247, SN74246, SN74247, SN74LS247 BCD-TO-SEVEN-SEGMENT DECODERS/DRIVERS

logic diagram (positive logic)

'246, '247, 'LS247



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

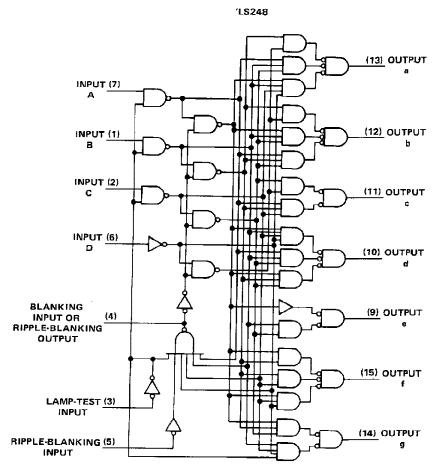






### SN54LS248, SN74LS248 BCD-TO-SEVEN-SEGMENT DECODERS/DRIVERS

#### logic diagram (positive logic)



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



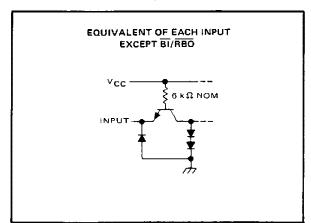




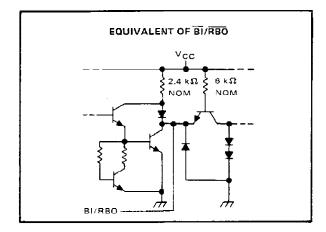
## SN54246, SN54247, SN74246, SN74247 BCD-TO-SEVEN-SEGMENT DECODERS/DRIVERS

### schematics of inputs and outputs

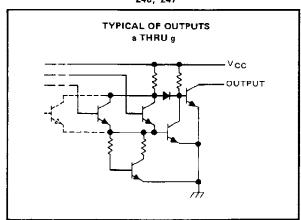
'246, '247



'246, '247



'246, '247









### SN54LS247, SN54LS248, SN74LS247, SN74LS248 BCD-TO-SEVEN-SEGMENT DECODERS/DRIVERS

#### schematics of inputs and outputs

'LS247, 'LS248

EQUIVALENT OF EACH INPUT EXCEPT BI/RBO

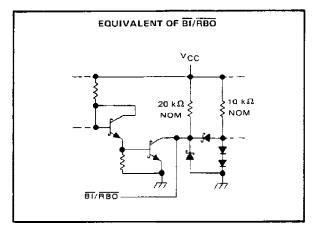
VCC

INPUT

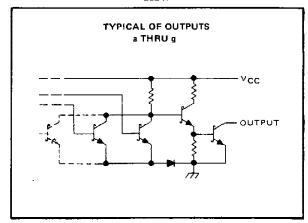
TT and RBI: Req = 20 kΩ NOM

A, B, C, and D: Req = 25 kΩ NOM

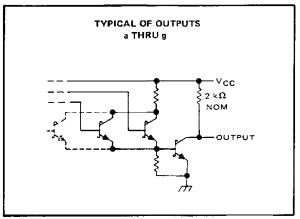
'LS247, 'LS248



'LS247



'LS248





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## SN54246, SN54247, SN74246, SN74247 BCD-TO-SEVEN-SEGMENT DECODERS/DRIVERS

absolute maximum ratings over operatin	g free	air	tem	pei	ratu	re	ran	nge	(uı	ıle:	SS	oth	er	wis	e	no	tec	1)				
Supply voltage, VCC (see Note 1)																						7 V
Input voltage																						5.5 V
Current forced into any output in the off	f state					-																1 mA
Operating free-air temperature range: SN	154246	, SN	542	47												-			-5	5°(	: to	125°C
31	174246	, SN	742	47										_						0	C t	o 70°C
Storage temperature range		٠		-			-		-	-									-6	5°(	to	150°C
NOTE 1: Voltage values are with respect to network	ground t	ermi	inal.																			

#### recommended operating conditions

			SN54246			SN5424	7	:	SN7424	6		N7424	7	
		MIN	NOM	MAX	MIN	NOM	MAX	MIN	NOM	MAX	MIN	NOM	MAX	TINU
Supply voltage, VCC		4.5	5	5.5	4.5	5	5.5	4.75	5	5.25	4.75	5	5.25	V
Off-state output voltage, Vo(off)	a thru g			30			15			30	i		15	V
On-state output current, IO(on)	a thru g			40			40			40			40	mΑ
High-level output current, IOH	BI/RBC			-200			-200			-200			200	μА
Low-level output current, IOL	BI/RBO			8			8			8			8	mA
Operating free-air temperature, T <sub>A</sub>	<u> </u>	-55		125	-55		125	0		70	0		70	°C

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

	PARAMETER		TEST CONDITIONS†	MIN	TYP	MAX	UNIT
ViH	High-level input voltage			2	_		V
VIL	Low-level input voltage			1		0.8	ν
VIK	Input clamp voltage		V <sub>CC</sub> = MIN, I₁ = -12 mA			1.5 V	٧
V <sub>OH</sub>	High-level output voltage	BI/RBO	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = 0.8 V, I <sub>OH</sub> = -200 μA	2.4	3.7		٧
VOL	Low-level output voltage	BI/RBO	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = 0.8 V, I <sub>OL</sub> = 8 mA		0.27	0.4	V
(O(off)	Off-state output current	a thru g	V <sub>CC</sub> = MAX, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = 0.8 V. V <sub>O(off)</sub> = MAX			250	μΑ
VO(on)	On-state output voltage	a thru g	$V_{CC} = MIN, V_{IH} = 2 V,$ $V_{IL} = 0.8 V, I_{O(\alpha n)} = 40 \text{ mA}$		0.3	0.4	٧
l <sub>k</sub>	Input current at maximum input voltage	Any input except BI/RBO	V <sub>CC</sub> = MAX, V <sub>I</sub> = 5.5 V	1		1	mA
Ιн	High-level input current	Any input except BI/RBO	V <sub>CC</sub> = MAX. V <sub>i</sub> = 2.4 V			40	μΑ
l <sub>IL</sub>	Low-level input current		V <sub>CC</sub> = MAX, V <sub>1</sub> = 0.4 V			-1.6	mA
	Shara in the state of the state	BI/RBO	- ALAW	<u> </u>		-4	
ios	Short-circuit output current	BI/RBO	VCC = MAX	<u> </u>		-4	mA
lcc	Supply current		V <sub>CC</sub> = MAX, See Note 2	i	64	103	mΑ

<sup>†</sup>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. NOTE 2:  $I_{CC}$  is measured with all outputs open and all inputs at 4.5 V.

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

	PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
toff	Turn-off time from A input				100	
ton	Turn-on time from A input	CL = 15 pF, RL = 120 Ω,			100	ns
toff	Turn-off time from RBI input	See Note 3			100	
ton	Turn-on time from RBI input				100	ns

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





Datasheet of SN74LS247D - IC BCD TO 7-SEG DECODER 16-SOIC

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### SN54LS247, SN74LS247 BCD-TO-SEVEN-SEGMENT DECODERS/DRIVERS

absolute maximum ratings over operating free-air	te	mį	oei	rat	ur	e r	an	ge	(ur	ıle	SS	ot	he	r۷	/is	e ı	10	tec	(k					
Supply voltage, VCC (see Note 1)																								7 V
Input voltage		,															-							7 V
Peak output current ( $t_W \le 1$ ms, duty cycle $\le 10\%$ )																								
Current forced into any output in the off state .																								
Operating free-air temperature range: SN54LS247																								
SN74LS247																								
Storage temperature range																				€	35°	C	to 1	50°C

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

#### recommended operating conditions

		SI	N54LS2	47	SI	N74LS2	47	UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	DIVIT
Supply voltage, V <sub>CC</sub>		4.5	5	5.5	4.75	5	5.25	٧
Off-state output voltage, VO(off)	a thru g			15			15	٧
On-state output current, IO(on)	a thru g	Ì		12			24	mA
High-level output current, IOH	BT/RBO			-50			50	μА
Low-level output current, IQL	BT/RBO			1.6			3.2	mΑ
Operating free-air temperature, TA		-55		125	0		70	°C

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

	B. B. HETER		TEST OOL	iniziatiot	SI	N54LS2	47	Sf	V74LS2	47	UNIT
	PARAMETER		I TEST CON	12NOITIDI	MIN	TYP‡	MAX	MIN	TYPİ	MAX	UNIT
VIH	High-level input voltage				2			2			٧
VIL	Low-level input voltage						0.7			8.0	V
VIK	Input clamp voltage		V <sub>CC</sub> = MIN,	I <sub>I</sub> = -18 mA			-1.5			-1.5	V
Voн	High-level output voltage	BI/RBO	V <sub>CC</sub> = MIN, V <sub>IL</sub> = V <sub>IL</sub> max,	V <sub>IH</sub> = 2 V, I <sub>OH</sub> = -50 μA	2.4	4.2		2.4	4.2		٧
N	Low-level output voltage	BI/RBO	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V,	IOL = 1.6 mA		0.25	0.4		0,25	0.4	V
VOL	Low-level output voltage	BITABO	ViH - 2 v, ViL = ViL max						0.35	0.5	
IO(off)	Off-state output current	a thru g	V <sub>CC</sub> = MAX, V <sub>IL</sub> = V <sub>IL</sub> max,	V <sub>IH</sub> = 2 V, V <sub>O(off)</sub> = 15 V			250			250	μА
Mar.	On-state output voltage	a thru q	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V,	IO(on) = 12 mA		0.25	0.4		0.25	0.4	v
VO(on)	On-state output vortage	a tinu y	V <sub>IL</sub> = V <sub>IL</sub> max	10(on) = 24 mA					0.35	0.5	
Ϊį	Input current at maximur	n input voltage	VCC = MAX,	V <sub>1</sub> = 7 V			0.1			0.1	mA
ПН	High-level input current		V <sub>CC</sub> = MAX.	V <sub>1</sub> = 2.7 V			20	"		20	μА
lı.	Low-level input current	Any input except BI/RBO	V <sub>CC</sub> = MAX,	V1 = 0.4 V			-0.4		·	-0.4	mA
		BI/RBO					-1.2			-1.2	
los	Short-circuit output current	BI/RBO	V <sub>CC</sub> = MAX		-0.3		2	-0.3		-2	πА
Icc	Supply current		V <sub>CC</sub> = MAX,	See Note 2		7	13		7	13	mA

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

### switching characteristics, $V_{CC}$ = 5 V, $T_A$ = 25° C

	PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
toff	Turn-off time from A input				100	ns
ton	Turn-on time from A input	$C_L = 15  pF, R_L = 665  \Omega,$			100	'''
toff	Turn-off time from RBI input	See Note 3			100	
ton	Turn-on time from RBI input				100	ns

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



<sup>‡</sup>All typical values are at  $V_{CC}$  = 5 V,  $T_A$  = 25° C. NOTE 2:  $I_{CC}$  is measured with all outputs open and all inputs at 4.5 V.

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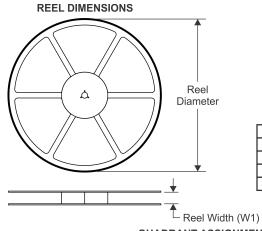
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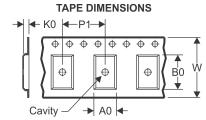


## PACKAGE MATERIALS INFORMATION

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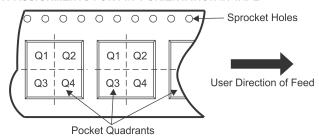
### TAPE AND REEL INFORMATION





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

### QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



#### \*All dimensions are nominal

Device	Package Type	Package Drawing		SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74LS247DR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1



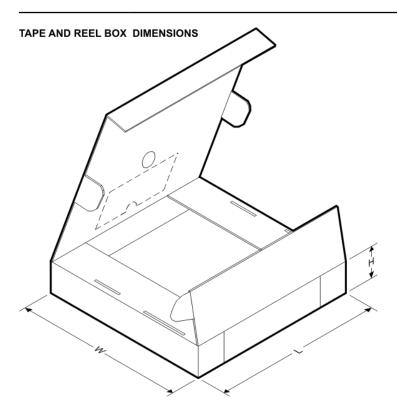
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## **PACKAGE MATERIALS INFORMATION**

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### \*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74LS247DR	SOIC	D	16	2500	333.2	345.9	28.6



Datasheet of SN74LS247D - IC BCD TO 7-SEG DECODER 16-SOIC

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