

**'246, '247, 'LS247
feature**

- Open-Collector Outputs Drive Indicators Directly
- Lamp-Test Provision
- Leading/Trailing Zero Suppression
- All Circuit Types Feature Lamp Intensity Modulation Capability

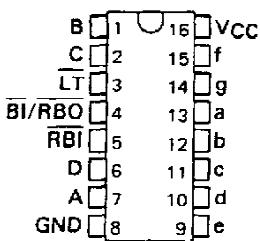
**'LS248
feature**

- Internal Pull-Ups Eliminate Need for External Resistors
- Lamp-Test Provision
- Leading/Trailing Zero Suppression

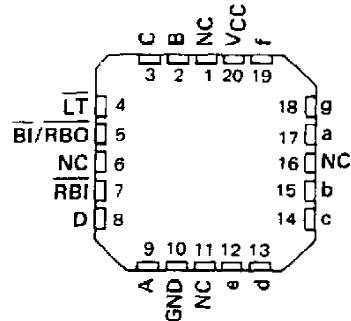
TYPE	DRIVER OUTPUTS				TYPICAL POWER DISSIPATION	PACKAGES
	ACTIVE LEVEL	OUTPUT CONFIGURATION	SINK CURRENT	MAX VOLTAGE		
SN54246	low	open-collector	40 mA	30 V	320 mW	J,W
SN54247	low	open-collector	40 mA	15 V	320 mW	J,W
SN54LS247	low	open-collector	12 mA	15 V	35 mW	J,W
SN54LS248	high	2-kΩ pull-up	2 mA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

**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

PRODUCTION DATA documents contain information 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**

POST OFFICE BOX 655012 • DALLAS, TEXAS 75265

SN54246, SN54247, SN54LS247, SN54LS248

SN74246, SN74247, SN74LS247, SN74LS248

BCD-TO-SEVEN-SEGMENT DECODERS/DRIVERS

description

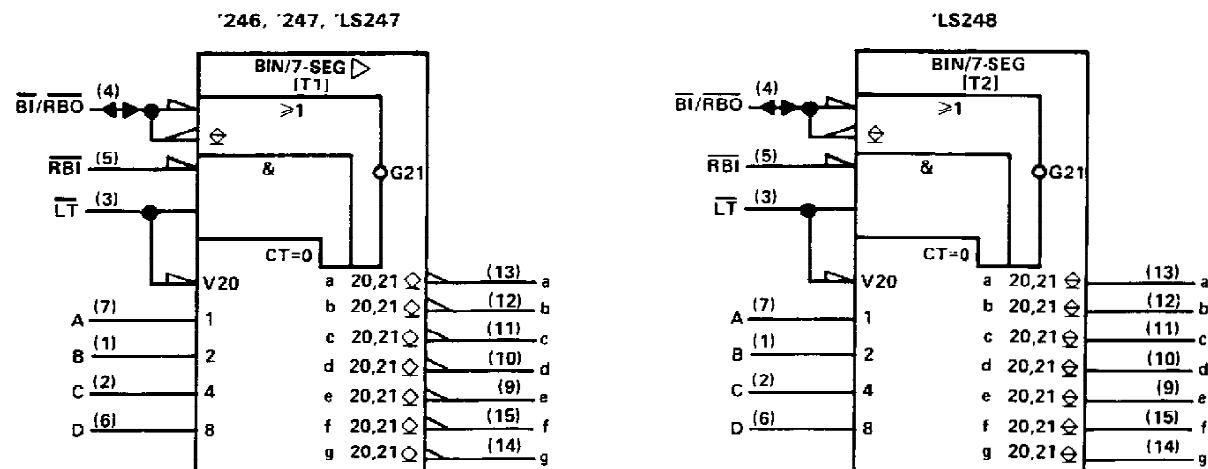
The '246 and '247 are electrically and functionally identical to the SN5446A/SN7446A, and SN5447A/SN7447A respectively, and have the same pin assignments as their equivalents. The 'LS247 and 'LS248 are electrically and functionally identical to the SN54LS47/SN74LS47 and SN54LS48/SN74LS48, respectively, 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 **b** and the **g** without tails and the '246, '247, 'LS247, and 'LS248 compose the **B** and the **G** 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 (RBI and RBO). Lamp test (LT) of these types may be performed at any time when the BI/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†



†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.

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

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

DECIMAL OR FUNCTION	INPUTS					<u>BI/RBO</u> [†]	OUTPUTS							NOTE
	LT	RBI	D	C	B	A	a	b	c	d	e	f	g	
0	H	H	L	L	L	L	H	ON	ON	ON	ON	ON	ON	OFF
1	H	X	L	L	L	H	H	OFF	ON	ON	OFF	OFF	OFF	OFF
2	H	X	L	L	H	L	H	ON	ON	OFF	ON	ON	OFF	ON
3	H	X	L	L	H	H	H	ON	ON	ON	OFF	OFF	ON	ON
4	H	X	L	H	L	L	H	OFF	ON	ON	OFF	ON	ON	ON
5	H	X	L	H	L	H	H	ON	OFF	ON	ON	OFF	ON	ON
6	H	X	L	H	H	L	H	ON	OFF	ON	ON	ON	ON	ON
7	H	X	L	H	H	H	H	ON	ON	OFF	OFF	OFF	OFF	OFF
8	H	X	H	L	L	L	H	ON						
9	H	X	H	L	L	H	H	ON	ON	ON	ON	OFF	ON	ON
10	H	X	H	L	H	L	H	OFF	OFF	OFF	ON	ON	OFF	ON
11	H	X	H	L	H	H	H	OFF	OFF	ON	ON	OFF	OFF	ON
12	H	X	H	H	L	L	H	OFF	ON	OFF	OFF	OFF	ON	ON
13	H	X	H	H	L	H	H	ON	OFF	OFF	ON	OFF	ON	ON
14	H	X	H	H	H	L	H	OFF	OFF	OFF	ON	ON	ON	ON
15	H	X	H	H	H	H	H	OFF						
<u>BI</u>	X	X	X	X	X	X	L	OFF	OFF	OFF	OFF	OFF	OFF	2
<u>RBI</u>	H	L	L	L	L	L	L	OFF	OFF	OFF	OFF	OFF	OFF	3
<u>LT</u>	L	X	X	X	X	X	H	ON	ON	ON	ON	ON	ON	4

'LS248 FUNCTION TABLE (T2)

DECIMAL OR FUNCTION	INPUTS					<u>BI/RBO</u> [†]	OUTPUTS							NOTE
	LT	RBI	D	C	B	A	a	b	c	d	e	f	g	
0	H	H	L	L	L	L	H	H	H	H	H	H	L	
1	H	X	L	L	L	H	H	L	H	H	L	L	L	
2	H	X	L	L	H	L	H	H	H	L	H	L	H	
3	H	X	L	L	H	H	H	H	H	H	L	L	H	
4	H	X	L	H	L	L	H	L	H	H	L	L	H	
5	H	X	L	H	H	L	H	H	L	H	H	L	H	
6	H	X	L	H	H	L	H	H	L	H	H	H	H	
7	H	X	L	H	H	H	H	H	H	H	L	L	L	
8	H	X	H	L	L	L	H	H	H	H	H	H	H	
9	H	X	H	L	L	H	H	H	H	H	H	L	H	
10	H	X	H	L	H	L	H	L	L	L	H	H	L	
11	H	X	H	L	H	H	H	L	L	H	H	L	H	
12	H	X	H	H	L	L	H	L	H	L	L	L	H	
13	H	X	H	H	L	H	H	H	L	L	H	L	H	
14	H	X	H	H	H	L	H	L	L	L	H	H	H	
15	H	X	H	H	H	H	H	L	L	L	L	L	L	
<u>BI</u>	X	X	X	X	X	X	L	L	L	L	L	L	L	2
<u>RBI</u>	H	L	L	L	L	L	L	L	L	L	L	L	L	3
<u>LT</u>	L	X	X	X	X	X	H	H	H	H	H	H	H	4

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

- NOTES: 1. The blanking input (BI) 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 other input.
3. 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).
4. 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).

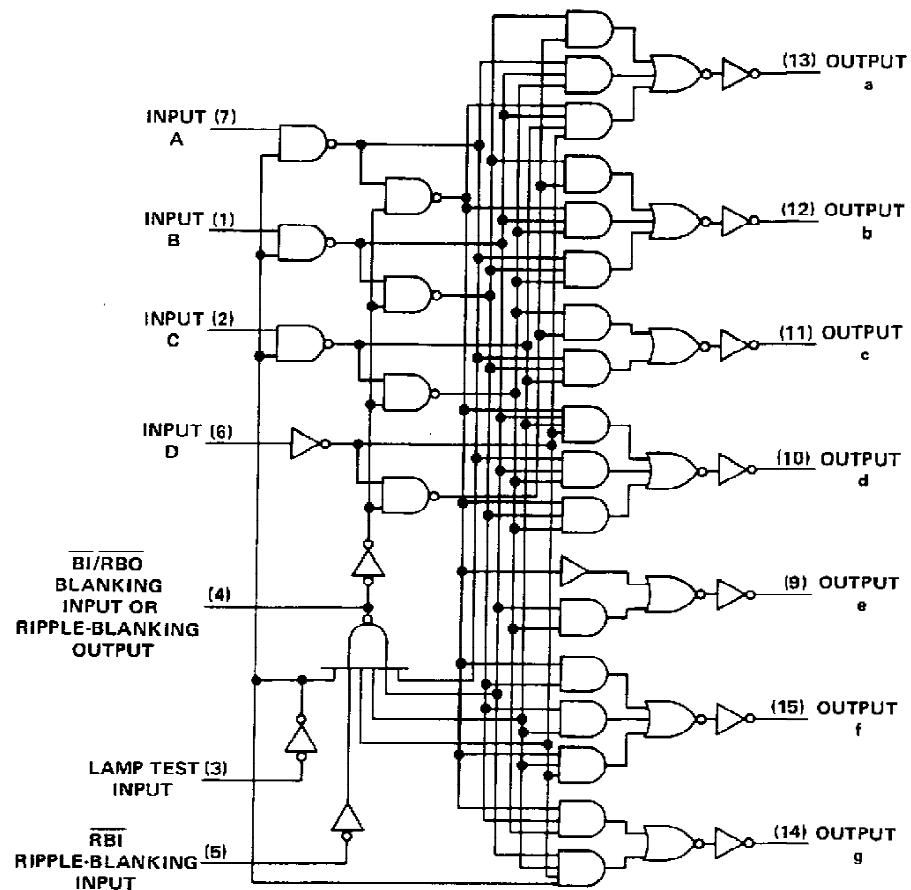
**TEXAS
INSTRUMENTS**

POST OFFICE BOX 655012 • DALLAS, TEXAS 75268

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

logic diagram (positive logic)

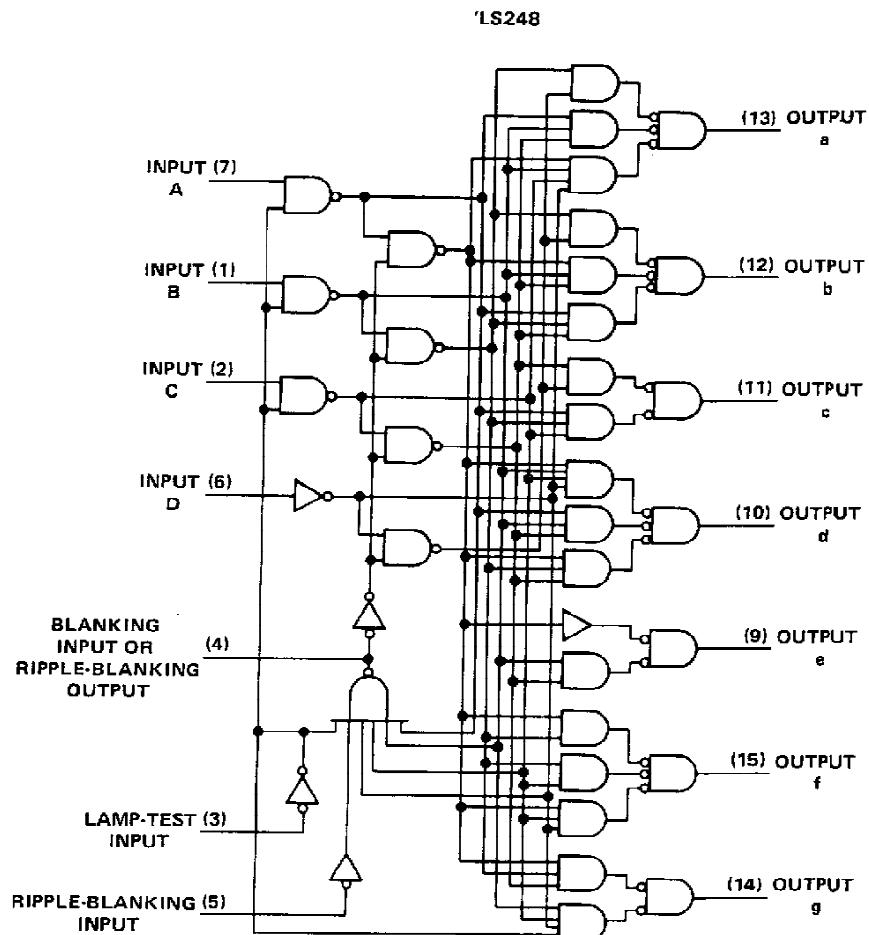
'246, '247, 'LS247



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

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

logic diagram (positive logic)

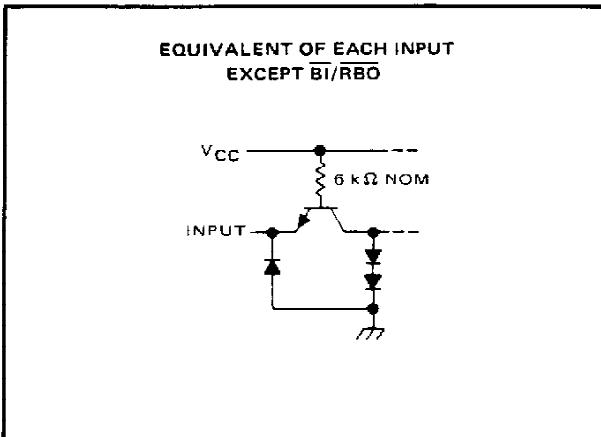


Pin numbers shown are for D, J, N, and W packages.

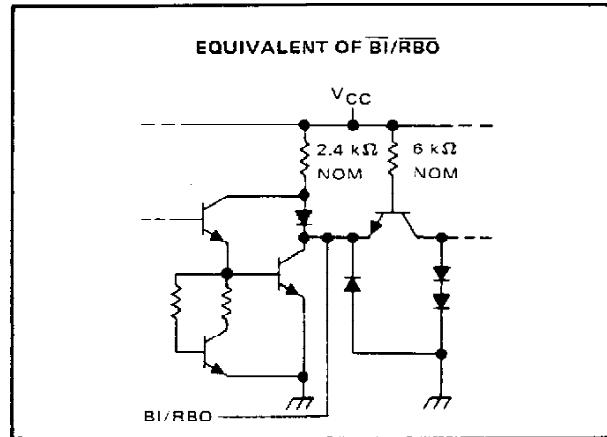
SN54246, SN54247, SN74246, SN74247 BCD-TO-SEVEN-SEGMENT DECODERS/DRIVERS

schematics of inputs and outputs

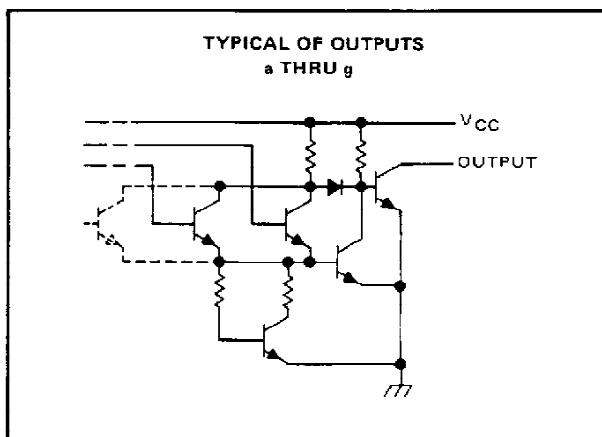
'246, '247



'246, '247



'246, '247



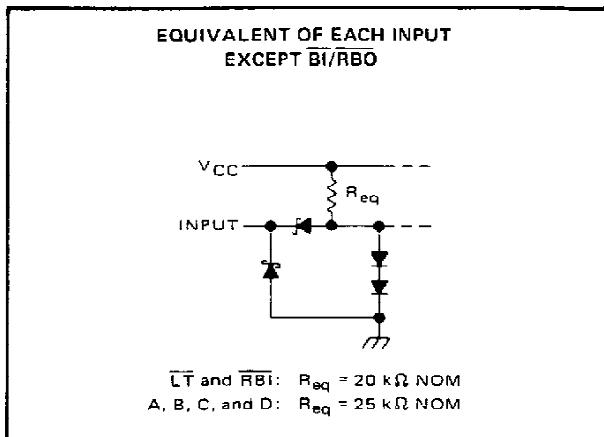
**TEXAS
INSTRUMENTS**

POST OFFICE BOX 655012 • DALLAS, TEXAS 75265

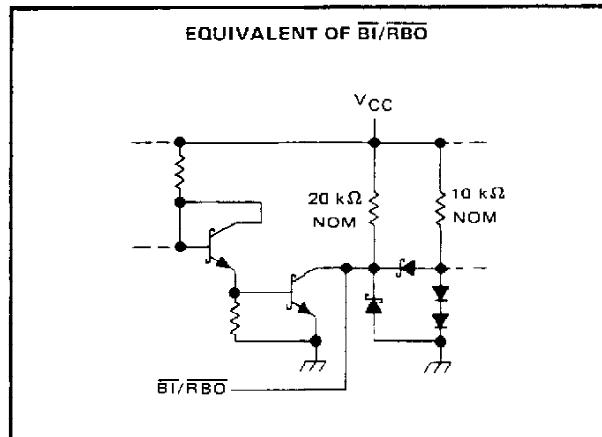
SN54LS247, SN54LS248, SN74LS247, SN74LS248 BCD-TO-SEVEN-SEGMENT DECODERS/DRIVERS

schematics of inputs and outputs

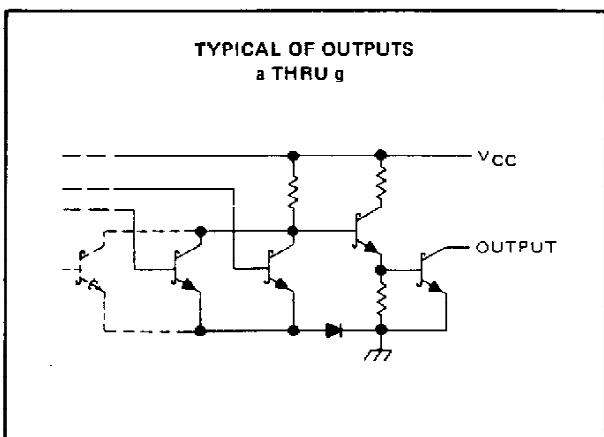
'LS247, 'LS248



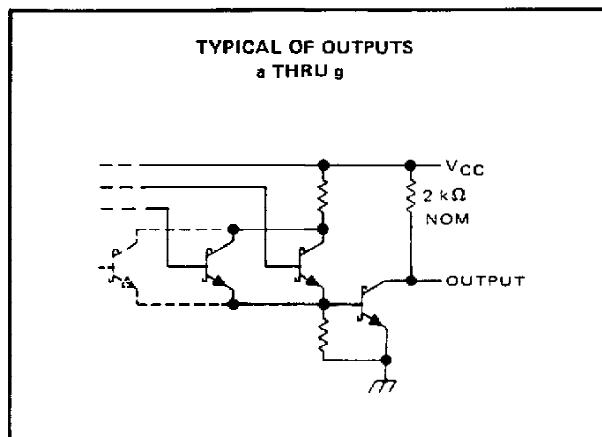
'LS247, 'LS248



‘LS247



• LS248



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

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

Supply voltage, V_{CC} (see Note 1)	7 V
Input voltage	5.5 V
Current forced into any output in the off state	1 mA
Operating free-air temperature range: SN54246, SN54247 SN74246, SN74247	-55°C to 125°C 0°C to 70°C -65°C to 150°C
Storage temperature range	-65°C to 150°C

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

recommended operating conditions

	SN54246			SN54247			SN74246			SN74247			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, V_{CC}	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, $V_{O(off)}$	a thru g		30			15			30			15	V
On-state output current, $I_{O(on)}$	a thru g		40			40			40			40	mA
High-level output current, I_{OH}	BI/RBO		-200			-200			-200			-200	μA
Low-level output current, I_{OL}	BI/RBO		8			8			8			8	mA
Operating free-air temperature, T_A	-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
V_{IH} High-level input voltage			2		V
V_{IL} Low-level input voltage				0.8	V
V_{IK} Input clamp voltage	$V_{CC} = \text{MIN}$, $I_I = -12 \text{ mA}$			1.5 V	V
V_{OH} High-level output voltage	BI/RBO	$V_{CC} = \text{MIN}$, $V_{IH} = 2 \text{ V}$, $V_{IL} = 0.8 \text{ V}$, $I_{OH} = -200 \mu\text{A}$	2.4	3.7	V
V_{OL} Low-level output voltage	BI/RBO	$V_{CC} = \text{MIN}$, $V_{IH} = 2 \text{ V}$, $V_{IL} = 0.8 \text{ V}$, $I_{OL} = 8 \text{ mA}$	0.27	0.4	V
$I_{O(off)}$ Off-state output current	a thru g	$V_{CC} = \text{MAX}$, $V_{IH} = 2 \text{ V}$, $V_{IL} = 0.8 \text{ V}$, $V_{O(off)} = \text{MAX}$		250	μA
$V_{O(on)}$ On-state output voltage	a thru g	$V_{CC} = \text{MIN}$, $V_{IH} = 2 \text{ V}$, $V_{IL} = 0.8 \text{ V}$, $I_{O(on)} = 40 \text{ mA}$	0.3	0.4	V
I_I Input current at maximum input voltage	Any input except BI/RBO	$V_{CC} = \text{MAX}$, $V_I = 5.5 \text{ V}$		1	mA
I_{IH} High-level input current	Any input except BI/RBO	$V_{CC} = \text{MAX}$, $V_I = 2.4 \text{ V}$		40	μA
I_{IL} Low-level input current	Any input except BI/RBO	$V_{CC} = \text{MAX}$, $V_I = 0.4 \text{ V}$		-1.6	mA
I_{OS} Short-circuit output current	BI/RBO			-4	mA
		$V_{CC} = \text{MAX}$		-4	mA
I_{CC} Supply current		$V_{CC} = \text{MAX}$, See Note 2	64	103	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 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
t_{off} Turn-off time from A input	$C_L = 15 \text{ pF}$, $R_L = 120 \Omega$, See Note 3			100	ns
t_{on} Turn-on time from A input				100	ns
t_{off} Turn-off time from \overline{RBI} input				100	ns
t_{on} Turn-on time from \overline{RBI} input				100	ns

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


TEXAS
INSTRUMENTS

POST OFFICE BOX 655012 • DALLAS, TEXAS 75265

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

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
Peak output current ($t_w \leq 1$ ms, duty cycle $\leq 10\%$)	200 mA
Current forced into any output in the off state	1 mA
Operating free-air temperature range: SN54LS247	-55°C to 125°C
SN74LS247	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

		SN54LS247			SN74LS247			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, $V_O(\text{off})$	a thru g		15		15		15	V
On-state output current, $I_O(\text{on})$	a thru g		12		24		24	mA
High-level output current, I_{OH}	BT/RBO		-50		-50		-50	μA
Low-level output current, I_{OL}	BT/RBO		1.6		3.2		3.2	mA
Operating free-air temperature, T_A		-55	125	0	70		70	°C

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

PARAMETER	TEST CONDITIONS [†]	SN54LS247			SN74LS247			UNIT
		MIN	TYP [‡]	MAX	MIN	TYP [‡]	MAX	
V_{IH} High-level input voltage		2		2	2		2	V
V_{IL} Low-level input voltage			0.7		0.7		0.8	V
V_{IK} Input clamp voltage	$V_{CC} = \text{MIN}$, $I_I = -18$ mA		-1.5		-1.5		-1.5	V
V_{OH} High-level output voltage	BT/RBO	$V_{CC} = \text{MIN}$, $V_{IH} = 2$ V, $V_{IL} = V_{IL}$ max, $I_{OH} = -50$ μA	2.4	4.2	2.4	4.2	2.4	V
V_{OL} Low-level output voltage	BT/RBO	$V_{CC} = \text{MIN}$, $V_{IH} = 2$ V, $V_{IL} = V_{IL}$ max	0.25	0.4	0.25	0.4	0.35	V
$I_O(\text{off})$ Off-state output current	a thru g	$V_{CC} = \text{MAX}$, $V_{IH} = 2$ V, $V_{IL} = V_{IL}$ max, $V_O(\text{off}) = 15$ V	250	250	250	250	250	μA
$V_O(\text{on})$ On-state output voltage	a thru g	$V_{CC} = \text{MIN}$, $V_{IH} = 2$ V, $V_{IL} = V_{IL}$ max	0.25	0.4	0.25	0.4	0.35	V
							0.35	0.5
I_I Input current at maximum input voltage		$V_{CC} = \text{MAX}$, $V_I = 7$ V		0.1		0.1		mA
I_{IH} High-level input current		$V_{CC} = \text{MAX}$, $V_I = 2.7$ V		20		20		μA
I_{IL} Low-level input current	Any input except BT/RBO	$V_{CC} = \text{MAX}$, $V_I = 0.4$ V		-0.4		-0.4		mA
				-1.2		-1.2		
I_{OS} Short-circuit output current	BT/RBO	$V_{CC} = \text{MAX}$	-0.3	-2	-0.3	-2		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 $V_{CC} = 5$ V, $T_A = 25^\circ\text{C}$.

NOTE 2: I_{CC} is measured with all outputs open and all inputs at 4.5 V.

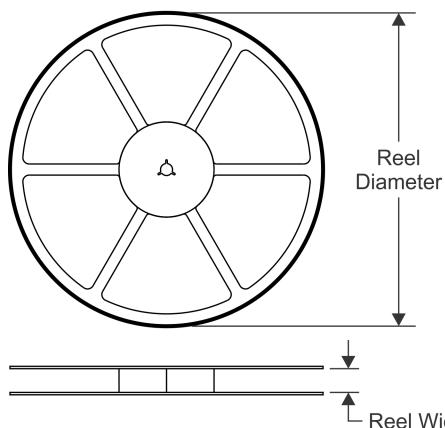
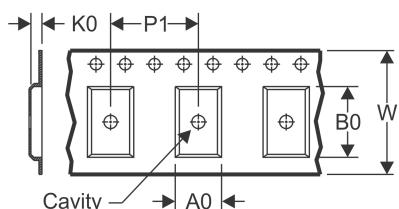
switching characteristics, $V_{CC} = 5$ V, $T_A = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{off} Turn-off time from A input	$C_L = 15$ pF, $R_L = 665$ Ω, See Note 3			100	ns
t_{on} Turn-on time from A input				100	ns
t_{off} Turn-off time from R _{BI} input				100	ns
t_{on} Turn-on time from R _{BI} input				100	ns

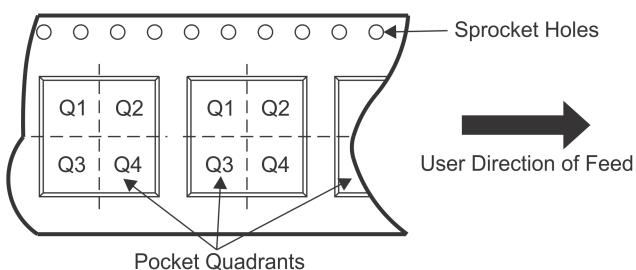
NOTE 3: Load circuits and voltage waveforms are shown in Section 1.

**TEXAS
INSTRUMENTS**

P.O. BOX 656012 • DALLAS, TEXAS 75265

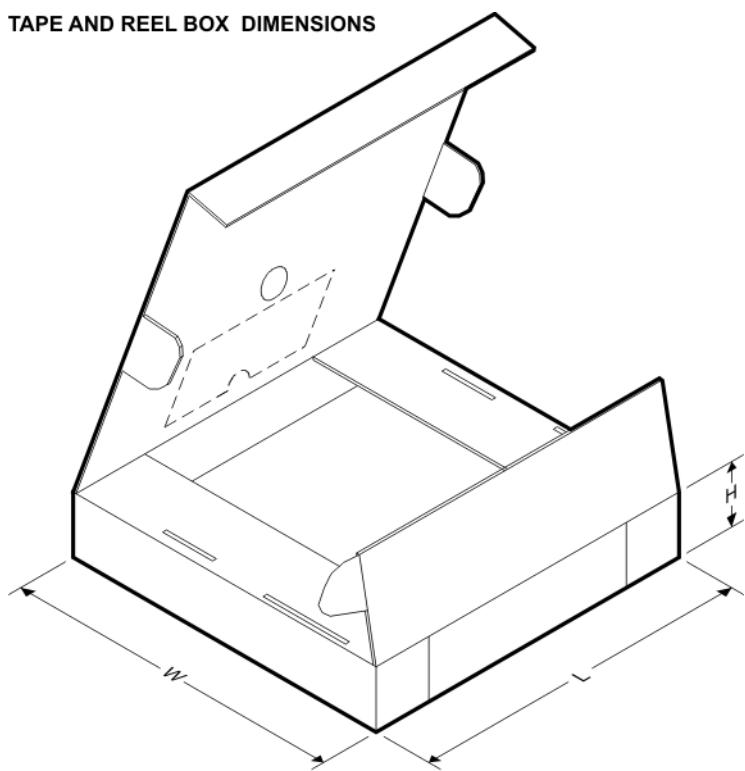
TAPE AND REEL INFORMATION
REEL DIMENSIONS

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

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE


*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
SN74LS247DR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	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)
SN74LS247DR	SOIC	D	16	2500	333.2	345.9	28.6

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as "components") are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI's terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers' products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers' products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of significant portions of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have **not** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

Products	Applications
Audio	www.ti.com/audio
Amplifiers	amplifier.ti.com
Data Converters	dataconverter.ti.com
DLP® Products	www.dlp.com
DSP	dsp.ti.com
Clocks and Timers	www.ti.com/clocks
Interface	interface.ti.com
Logic	logic.ti.com
Power Mgmt	power.ti.com
Microcontrollers	microcontroller.ti.com
RFID	www.ti-rfid.com
OMAP Applications Processors	www.ti.com/omap
Wireless Connectivity	www.ti.com/wirelessconnectivity
	TI E2E Community
	e2e.ti.com