

'246, '247, 'LS247
feature

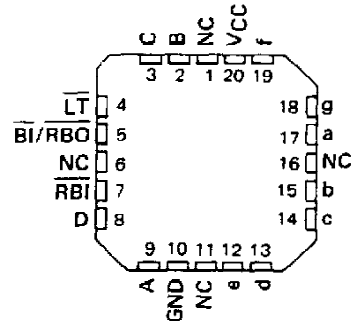
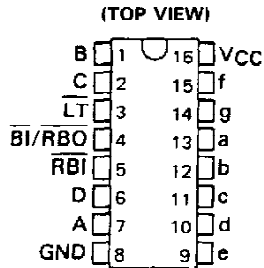
'LS248
feature

- 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

| 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

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



NC - No internal connection

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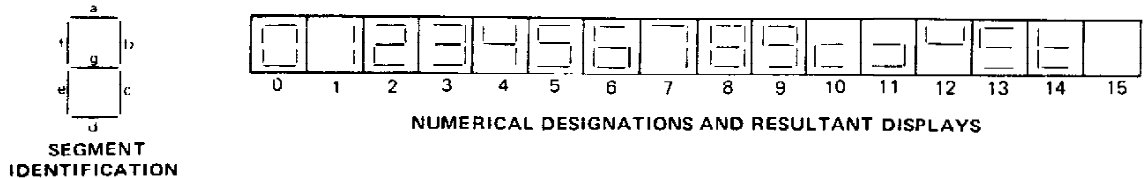
SN54246, SN54247, SN54LS247, SN54LS248 SN74246, SN74247, SN74LS247, SN74LS248 BCD-TO-SEVEN-SEGMENT DECODERS/DRIVERS

description

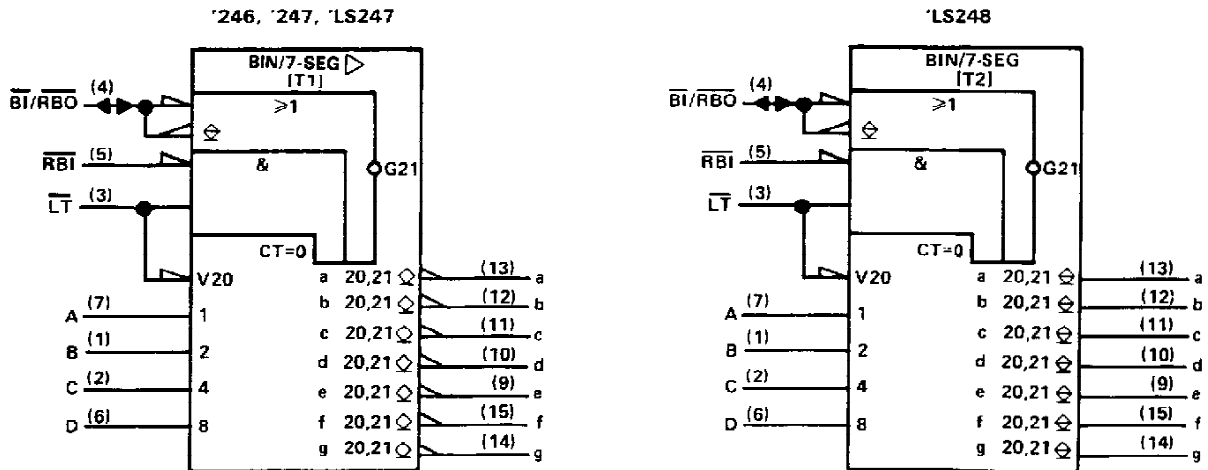
The '246 and '247 are electrically and functionally identical to the SN5446A/SN7446A, and SN5447A/SN7447A respectively, and have the same pin assignments as their equivalents. The 'LS247 and 'LS248 are electrically and functionally identical to the SN54LS47/SN74LS47 and SN54LS48/SN74LS48, respectively, 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 \bar{b} and the \bar{c} without tails and the '246, '247, 'LS247, and 'LS248 compose the \bar{b} and the \bar{c} 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†



†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 | | | | | | $\overline{\text{BI}}/\overline{\text{RBO}}^\dagger$ | 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 | ON | OFF | OFF | ON | |
| 4 | H | X | L | H | L | L | H | OFF | ON | ON | OFF | OFF | 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 | ON | OFF | OFF | OFF | OFF | |
| 8 | H | X | H | L | L | L | H | ON | ON | ON | ON | ON | ON | 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 | OFF | OFF | OFF | OFF | OFF | OFF | |
| $\overline{\text{BI}}$ | X | X | X | X | X | X | L | OFF | OFF | OFF | OFF | OFF | OFF | OFF | 2 |
| $\overline{\text{RBI}}$ | H | L | L | L | L | L | L | OFF | OFF | OFF | OFF | OFF | OFF | OFF | 3 |
| $\overline{\text{LT}}$ | L | X | X | X | X | X | H | ON | ON | ON | ON | ON | ON | ON | 4 |

'LS248 FUNCTION TABLE (T2)

| DECIMAL OR FUNCTION | INPUTS | | | | | | $\overline{\text{BI}}/\overline{\text{RBO}}^\dagger$ | 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 | L | |
| 1 | H | X | L | L | L | H | H | L | H | H | L | L | L | L | |
| 2 | H | X | L | L | H | L | H | H | H | L | H | H | L | H | |
| 3 | H | X | L | L | H | H | H | H | H | H | H | L | L | H | |
| 4 | H | X | L | H | L | L | H | L | H | H | L | L | H | H | |
| 5 | H | X | L | H | L | H | H | H | L | H | H | L | H | H | |
| 6 | H | X | L | H | H | L | H | H | L | H | H | H | H | H | |
| 7 | H | X | L | H | H | H | H | H | H | H | L | L | L | L | |
| 8 | H | X | H | L | L | L | H | H | H | H | H | H | H | H | |
| 9 | H | X | H | L | L | H | H | H | H | H | H | L | H | H | |
| 10 | H | X | H | L | H | L | H | L | L | L | H | H | L | H | |
| 11 | H | X | H | L | H | H | H | L | L | H | H | L | L | H | |
| 12 | H | X | H | H | L | L | H | L | H | L | L | L | H | H | |
| 13 | H | X | H | H | L | H | H | H | L | L | L | H | L | H | |
| 14 | H | X | H | H | H | L | H | L | L | L | H | H | H | H | |
| 15 | H | X | H | H | H | H | H | L | L | L | L | L | L | L | |
| $\overline{\text{BI}}$ | X | X | X | X | X | X | L | L | L | L | L | L | L | L | 2 |
| $\overline{\text{RBI}}$ | H | L | L | L | L | L | L | L | L | L | L | L | L | L | 3 |
| $\overline{\text{LT}}$ | L | X | X | X | X | X | H | H | H | H | H | H | H | H | 4 |

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

- NOTES: 1. The blanking input ($\overline{\text{BI}}$) must be open or held at a high logic level when output functions 0 through 15 are desired. The ripple-blanking input ($\overline{\text{RBI}}$) 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 ($\overline{\text{BI}}$), all segment outputs are low regardless of the level of any other input.
3. When ripple-blanking input ($\overline{\text{RBI}}$) 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 ($\overline{\text{RBO}}$) goes to a low level (response condition).
4. When the blanking input/ripple-blanking output ($\overline{\text{BI}}/\overline{\text{RBO}}$) is open or held high and a low is applied to the lamp-test input, all segment outputs are high.

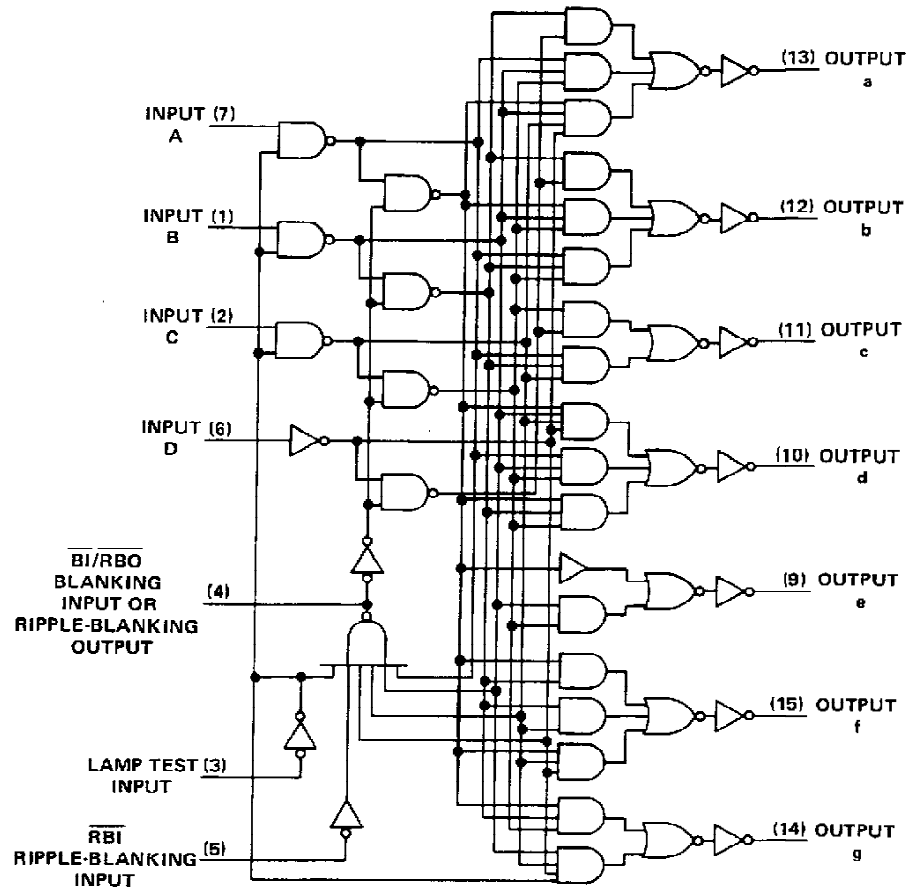
$^\dagger \overline{\text{BI}}/\overline{\text{RBO}}$ is wire-AND logic serving as blanking input ($\overline{\text{BI}}$) and/or ripple-blanking output ($\overline{\text{RBO}}$).



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

logic diagram (positive logic)

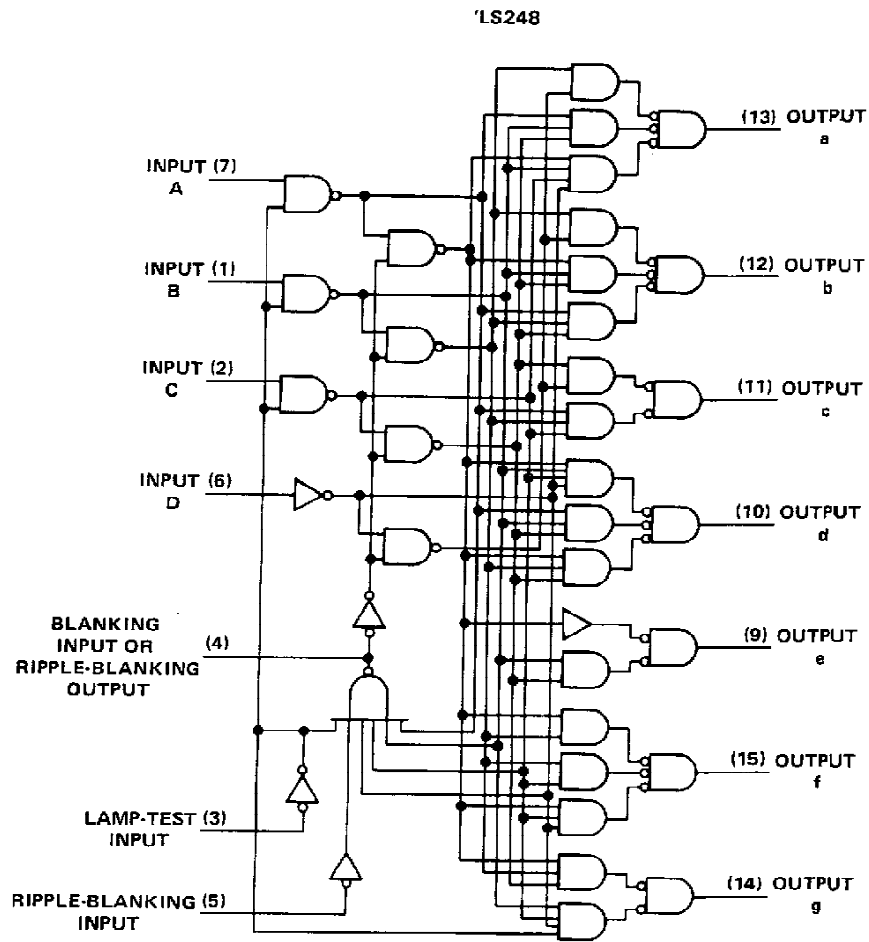
'246, '247, 'LS247



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.

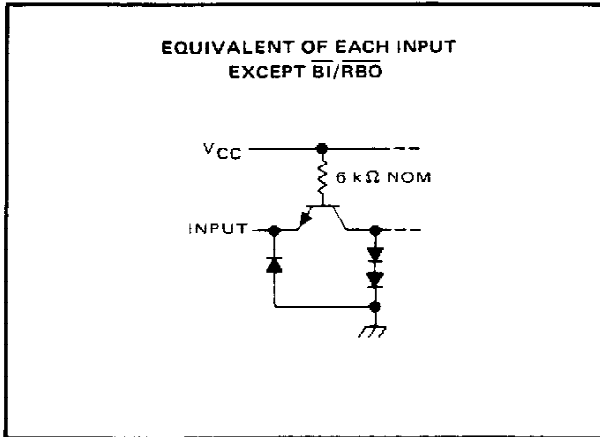
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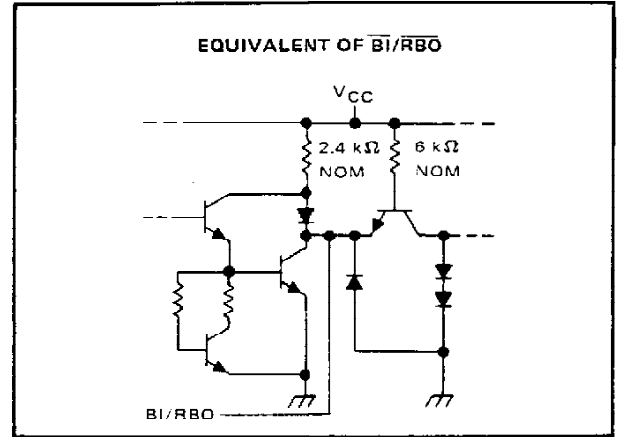
SN54246, SN54247, SN74246, SN74247 BCD-TO-SEVEN-SEGMENT DECODERS/DRIVERS

schematics of inputs and outputs

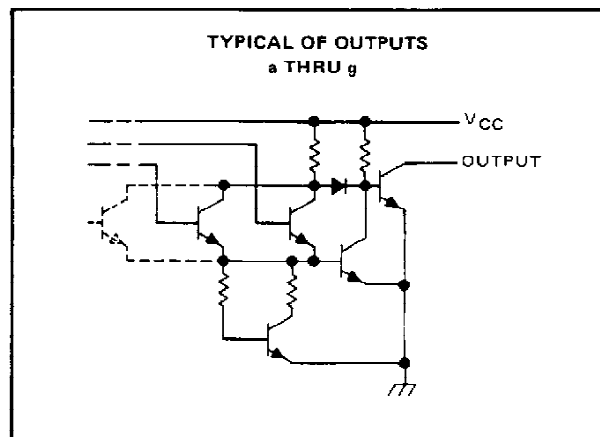
'246, '247



'246, '247



'246, '247



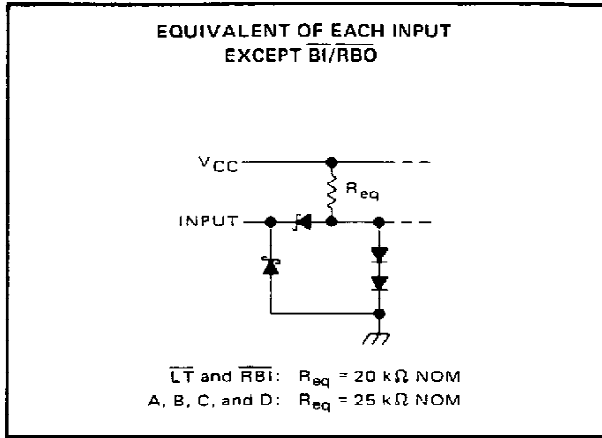
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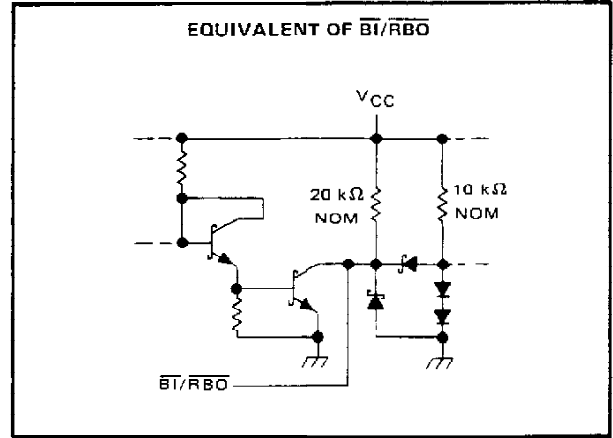
SN54LS247, SN54LS248, SN74LS247, SN74LS248 BCD-TO-SEVEN-SEGMENT DECODERS/DRIVERS

schematics of inputs and outputs

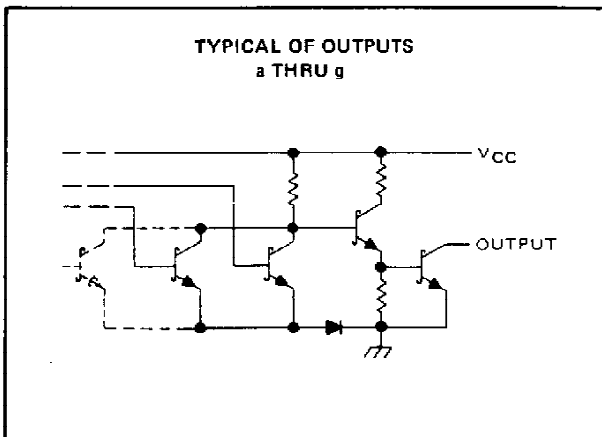
'LS247, 'LS248



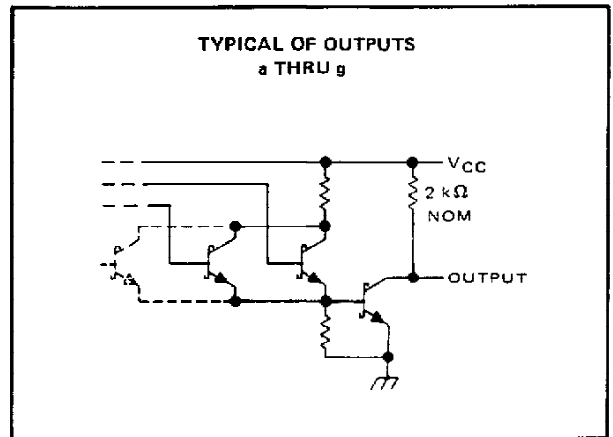
'LS247, 'LS248



'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 | -55°C to 125°C |
| SN74246, SN74247 | 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

| | 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} | $\overline{BI}/\overline{RBO}$ | | | -200 | | | -200 | | | -200 | | | -200 | μ A | |
| Low-level output current, I_{OL} | $\overline{BI}/\overline{RBO}$ | | | 8 | | | 8 | | | 8 | | | 8 | mA | |
| Operating free-air temperature, T_A | -55 | | | 125 | | | -55 | | | 125 | | | 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_{OH} | High-level output voltage | $\overline{BI}/\overline{RBO}$ $V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V},$ $V_{IL} = 0.8 \text{ V}, I_{OH} = -200 \mu\text{A}$ | 2.4 | 3.7 | | V |
| V_{OL} | Low-level output voltage | $\overline{BI}/\overline{RBO}$ $V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V},$ $V_{IL} = 0.8 \text{ V}, I_{OL} = 8 \text{ mA}$ | 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 | μ A |
| $V_{O(on)}$ | 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 $\overline{BI}/\overline{RBO}$ $V_{CC} = \text{MAX}, V_I = 5.5 \text{ V}$ | | | 1 | mA |
| I_{IH} | High-level input current | Any input except $\overline{BI}/\overline{RBO}$ $V_{CC} = \text{MAX}, V_I = 2.4 \text{ V}$ | | | 40 | μ A |
| I_{IL} | Low-level input current | Any input except $\overline{BI}/\overline{RBO}$ $V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$ | | | -1.6 | mA |
| | | $\overline{BI}/\overline{RBO}$ | | | -4 | |
| I_{OS} | Short-circuit output current | $\overline{BI}/\overline{RBO}$ $V_{CC} = \text{MAX}$ | | | -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 | |
| t_{off} | Turn-off time from \overline{RBI} input | | | | 100 | ns |
| t_{on} | Turn-on time from \overline{RBI} input | | | | 100 | |

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

TEXAS
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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, $V_{O(off)}$ | a thru g | | | 15 | | | V |
| On-state output current, $I_{O(on)}$ | a thru g | | | 12 | | | mA |
| High-level output current, I_{OH} | $\overline{BI}/\overline{RBO}$ | | | -50 | | | μA |
| Low-level output current, I_{OL} | $\overline{BI}/\overline{RBO}$ | | | 1.6 | | | mA |
| Operating free-air temperature, T_A | -55 | 125 | | 0 | 70 | | $^\circ\text{C}$ |

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 | | | 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 |
| V_{OH} | High-level output voltage | $\overline{BI}/\overline{RBO}$ $V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V},$ $V_{IL} = V_{IL \text{ max}}, I_{OH} = -50 \mu\text{A}$ | 2.4 | 4.2 | | 2.4 | 4.2 | | V |
| V_{OL} | Low-level output voltage | $\overline{BI}/\overline{RBO}$ $V_{CC} = \text{MIN},$ $V_{IH} = 2 \text{ V},$ $V_{IL} = V_{IL \text{ max}}$ | $I_{OL} = 1.6 \text{ mA}$ | | 0.25 | 0.4 | $I_{OL} = 3.2 \text{ mA}$ | | V |
| $I_{O(off)}$ | Off-state output current | a thru g $V_{CC} = \text{MAX}, V_{IH} = 2 \text{ V},$ $V_{IL} = V_{IL \text{ max}}, V_{O(off)} = 15 \text{ V}$ | 250 | | | 250 | | | μA |
| $V_{O(on)}$ | On-state output voltage | a thru g $V_{CC} = \text{MIN},$ $V_{IH} = 2 \text{ V},$ $V_{IL} = V_{IL \text{ max}}$ | $I_{O(on)} = 12 \text{ mA}$ | | 0.25 | 0.4 | $I_{O(on)} = 24 \text{ mA}$ | | V |
| 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 | Any input except $\overline{BI}/\overline{RBO}$ | $V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$ | | | -0.4 | | | mA |
| | | $\overline{BI}/\overline{RBO}$ | | | | -1.2 | | | |
| I_{OS} | Short-circuit output current | $\overline{BI}/\overline{RBO}$ $V_{CC} = \text{MAX}$ | -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 $V_{CC} = 5 \text{ V}, T_A = 25^\circ\text{C}$.

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 | | | 100 | ns |
| t_{on} | Turn-on time from A input | $C_L = 15 \text{ pF}, R_L = 665 \Omega,$ | | 100 | |
| t_{off} | Turn-off time from \overline{RBI} input | See Note 3 | | 100 | ns |
| t_{on} | Turn-on time from \overline{RBI} input | | | 100 | |

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



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 |
|--------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74LS247DR | SOIC | D | 16 | 2500 | 330.0 | 16.4 | 6.5 | 10.3 | 2.1 | 8.0 | 16.0 | Q1 |
| SN74LS247NSR | 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) |
|--------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74LS247DR | SOIC | D | 16 | 2500 | 333.2 | 345.9 | 28.6 |
| SN74LS247NSR | SO | NS | 16 | 2000 | 367.0 | 367.0 | 38.0 |

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