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Jameco Part Number 917062

SN5446A, '47A, '48, SN54LS47, 'LS48, 'LS49  
 SN7446A, '47A, '48, SN74LS47, 'LS48, 'LS49  
 BCD-TO-SEVEN-SEGMENT DECODERS/DRIVERS

SDLS111 – MARCH 1974 – REVISED MARCH 1988

'46A, '47A, 'LS47  
 feature

- Open-Collector Outputs Drive Indicators Directly
- Lamp-Test Provision
- Leading/Trailing Zero Suppression

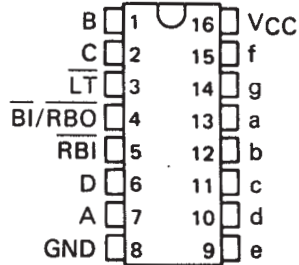
'48, 'LS48  
 feature

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

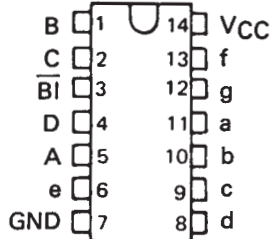
'LS49  
 feature

- Open-Collector Outputs
- Blanking Input

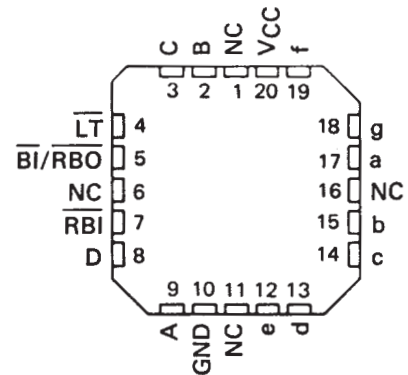
SN5446A, SN5447A, SN54LS47, SN5448,  
 SN54LS48 . . . J PACKAGE  
 SN7446A, SN7447A,  
 SN7448 . . . N PACKAGE  
 SN74LS47, SN74LS48 . . . D OR N PACKAGE  
 (TOP VIEW)



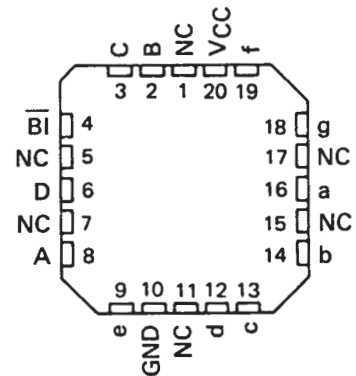
SN54LS49 . . . J OR W PACKAGE  
 SN74LS49 . . . D OR N PACKAGE  
 (TOP VIEW)



SN54LS47, SN54LS48 . . . FK PACKAGE  
 (TOP VIEW)



SN54LS49 . . . FK PACKAGE  
 (TOP VIEW)



NC — No internal connection

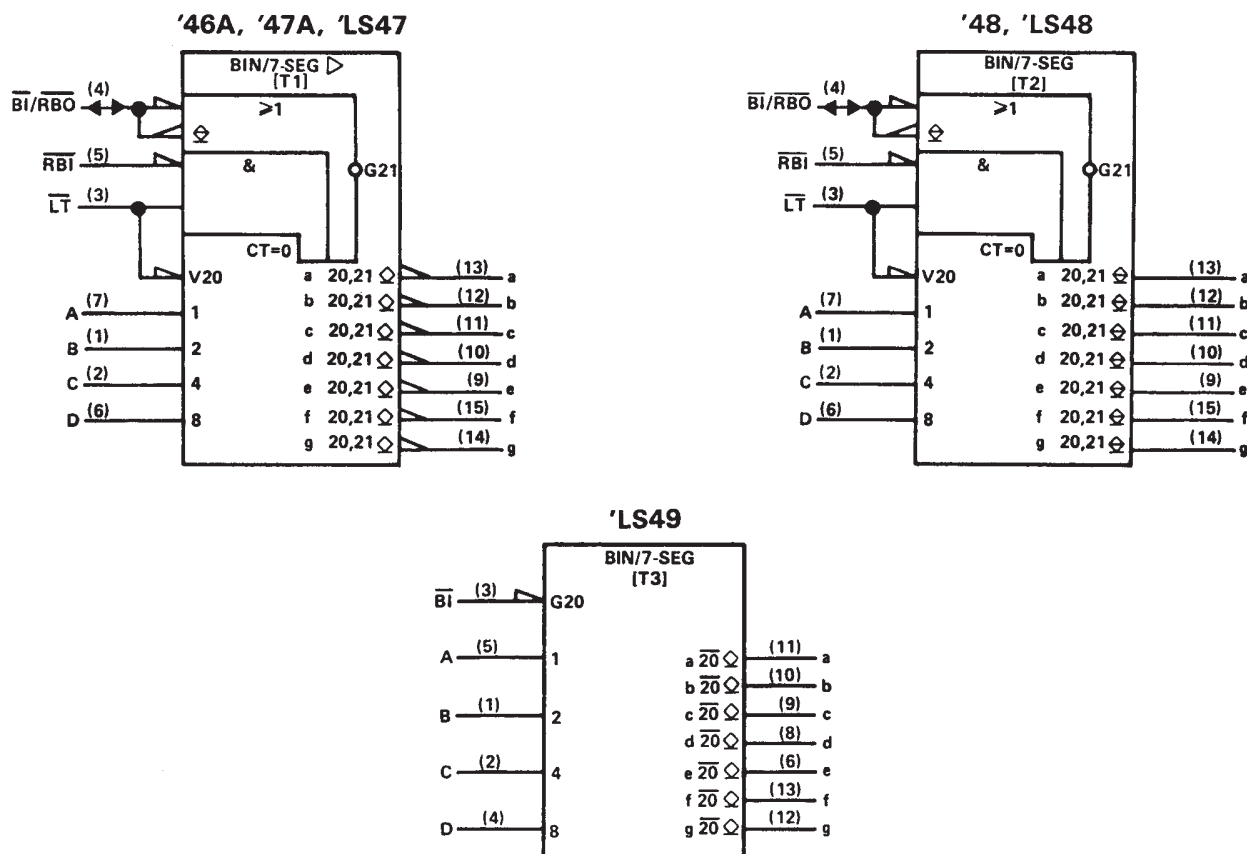
SN5446A, '47A, '48, SN54LS47, 'LS48, 'LS49  
 SN7446A, '47A, '48, SN74LS47, 'LS48, 'LS49  
 BCD-TO-SEVEN-SEGMENT DECODERS/DRIVERS

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- All Circuit Types Feature Lamp Intensity Modulation Capability

| TYPE     | DRIVER OUTPUTS  |                         |                 |                | TYPICAL<br>POWER<br>DISSIPATION | PACKAGES |
|----------|-----------------|-------------------------|-----------------|----------------|---------------------------------|----------|
|          | ACTIVE<br>LEVEL | OUTPUT<br>CONFIGURATION | SINK<br>CURRENT | MAX<br>VOLTAGE |                                 |          |
| SN5446A  | low             | open-collector          | 40 mA           | 30 V           | 320 mW                          | J, W     |
| SN5447A  | low             | open-collector          | 40 mA           | 15 V           | 320 mW                          | J, W     |
| SN5448   | high            | 2-k $\Omega$ pull-up    | 6.4 mA          | 5.5 V          | 265 mW                          | J, W     |
| SN54LS47 | low             | open-collector          | 12 mA           | 15 V           | 35 mW                           | J, W     |
| SN54LS48 | high            | 2-k $\Omega$ pull-up    | 2 mA            | 5.5 V          | 125 mW                          | J, W     |
| SN54LS49 | high            | open-collector          | 4 mA            | 5.5 V          | 40 mW                           | J, W     |
| SN7446A  | low             | open-collector          | 40 mA           | 30 V           | 320 mW                          | J, N     |
| SN7447A  | low             | open-collector          | 40 mA           | 15 V           | 320 mW                          | J, N     |
| SN7448   | high            | 2-k $\Omega$ pull-up    | 6.4 mA          | 5.5 V          | 265 mW                          | J, N     |
| SN74LS47 | low             | open-collector          | 24 mA           | 15 V           | 35 mW                           | J, N     |
| SN74LS48 | high            | 2-k $\Omega$ pull-up    | 6 mA            | 5.5 V          | 125 mW                          | J, N     |
| SN74LS49 | high            | open-collector          | 8 mA            | 5.5 V          | 40 mW                           | J, N     |

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.

SN5446A, '47A, '48, SN54LS47, 'LS48, 'LS49  
SN7446A, '47A, '48, SN74LS47, 'LS48, 'LS49  
BCD-TO-SEVEN-SEGMENT DECODERS/DRIVERS

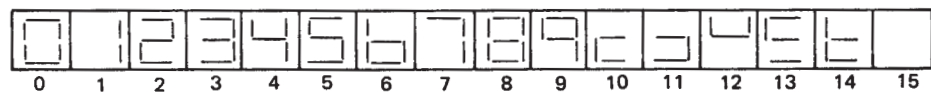
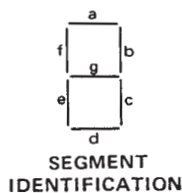
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## description

The '46A, '47A, and 'LS47 feature active-low outputs designed for driving common-anode LEDs or incandescent indicators directly. The '48, 'LS48, and 'LS49 feature active-high outputs for driving lamp buffers or common-cathode LEDs. All of the circuits except 'LS49 have full ripple-blanking input/output controls and a lamp test input. The 'LS49 circuit incorporates a direct blanking input. Segment identification and resultant displays are shown below. Display patterns for BCD input counts above 9 are unique symbols to authenticate input conditions.

The '46A, '47A, '48, 'LS47, and 'LS48 circuits incorporate automatic leading and/or trailing-edge zero-blanking control ( $\overline{\text{RBI}}$  and  $\overline{\text{RBO}}$ ). Lamp test ( $\overline{\text{LT}}$ ) of these types may be performed at any time when the  $\overline{\text{BI/RBO}}$  node is at a high level. All types (including the '49 and 'LS49) contain an overriding blanking input ( $\overline{\text{BI}}$ ), 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.

The SN54246/SN74246 and '247 and the SN54LS247/SN74LS247 and 'LS248 compose the  and the  with tails and were designed to offer the designer a choice between two indicator fonts.



NUMERICAL DESIGNATIONS AND RESULTANT DISPLAYS

'46A, '47A, 'LS47 FUNCTION TABLE (T1)

| DECIMAL<br>OR<br>FUNCTION | INPUTS                 |                         |   |   |   |   | $\overline{\text{BI/RBO}}^\dagger$ | OUTPUTS |     |     |     |     |     |     | NOTE |
|---------------------------|------------------------|-------------------------|---|---|---|---|------------------------------------|---------|-----|-----|-----|-----|-----|-----|------|
|                           | $\overline{\text{LT}}$ | $\overline{\text{RBI}}$ | 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    |
| 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                                  | OFF     | 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  | OFF | 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 |      |
| BI                        | X                      | X                       | X | X | X | X | L                                  | OFF     | OFF | OFF | OFF | OFF | OFF | OFF | 2    |
| RBI                       | H                      | L                       | L | L | L | L | L                                  | OFF     | OFF | OFF | OFF | OFF | OFF | OFF | 3    |
| LT                        | L                      | X                       | X | X | X | X | H                                  | ON      | ON  | ON  | ON  | ON  | ON  | ON  | 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 off 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 off and the ripple-blanking output ( $\overline{\text{RBO}}$ ) goes to a low level (response condition).

4. When the blanking input/ripple blanking output ( $\overline{\text{BI/RBO}}$ ) is open or held high and a low is applied to the lamp-test input, all segment outputs are on.

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

SN5446A, '47A, '48, SN54LS47, 'LS48, 'LS49  
 SN7446A, '47A, '48, SN74LS47, 'LS48, 'LS49  
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'48, 'LS48  
 FUNCTION TABLE (T2)

| DECIMAL<br>OR<br>FUNCTION | INPUTS                 |                         |   |   |   |   | $\overline{\text{BI}}/\overline{\text{RBO}}^\dagger$ | OUTPUTS |   |   |   |   |   |   | NOTE |
|---------------------------|------------------------|-------------------------|---|---|---|---|------------------------------------------------------|---------|---|---|---|---|---|---|------|
|                           | $\overline{\text{LT}}$ | $\overline{\text{RBI}}$ | D | C | B | A |                                                      | a       | b | c | d | e | f | g |      |
| 0                         | H                      | H                       | L | L | L | L | H                                                    | H       | H | H | H | H | H | L | 1    |
| 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 | L | 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                                                    | L       | 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 | L | L | 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 |      |
| BI                        | X                      | X                       | X | X | X | X | L                                                    | L       | L | L | L | L | L | L | 2    |
| RBI                       | L                      | L                       | L | L | L | L | L                                                    | L       | L | L | L | L | L | L | 3    |
| 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 ( $\overline{\text{RBO}}$ ).

'LS49  
 FUNCTION TABLE (T3)

| DECIMAL<br>OR<br>FUNCTION | INPUTS |   |   |   |                        | OUTPUTS |   |   |   |   |   |   | NOTE |
|---------------------------|--------|---|---|---|------------------------|---------|---|---|---|---|---|---|------|
|                           | D      | C | B | A | $\overline{\text{BI}}$ | a       | b | c | d | e | f | g |      |
| 0                         | L      | L | L | L | H                      | H       | H | H | H | H | H | L | 1    |
| 1                         | L      | L | L | H | H                      | L       | H | H | L | L | L | L |      |
| 2                         | L      | L | H | L | H                      | H       | H | L | H | H | L | H |      |
| 3                         | L      | L | H | H | H                      | H       | H | H | H | L | L | H |      |
| 4                         | L      | H | L | L | H                      | L       | H | H | L | L | H | H |      |
| 5                         | L      | H | L | H | H                      | H       | L | H | H | L | H | H |      |
| 6                         | L      | H | H | L | H                      | L       | L | H | H | H | H | H |      |
| 7                         | L      | H | H | H | H                      | H       | H | H | L | L | L | L |      |
| 8                         | H      | L | L | L | H                      | H       | H | H | H | H | H | H |      |
| 9                         | H      | L | L | H | H                      | H       | H | H | L | L | H | H |      |
| 10                        | H      | L | H | L | H                      | L       | L | L | H | H | L | H |      |
| 11                        | H      | L | H | H | H                      | L       | L | H | H | L | L | H |      |
| 12                        | H      | H | L | L | H                      | L       | H | L | L | L | H | H |      |
| 13                        | H      | H | L | H | H                      | H       | L | L | L | H | H | H |      |
| 14                        | H      | H | H | L | H                      | L       | L | L | H | H | H | H |      |
| 15                        | H      | H | H | H | H                      | L       | L | L | L | L | L | L |      |
| BI                        | X      | X | X | X | L                      | L       | L | L | L | L | L | L | 2    |

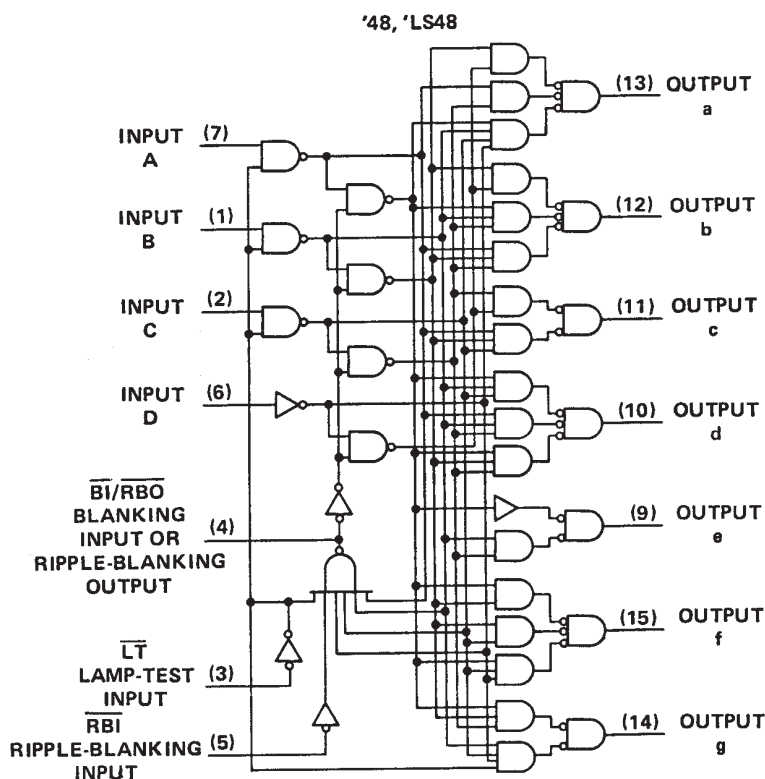
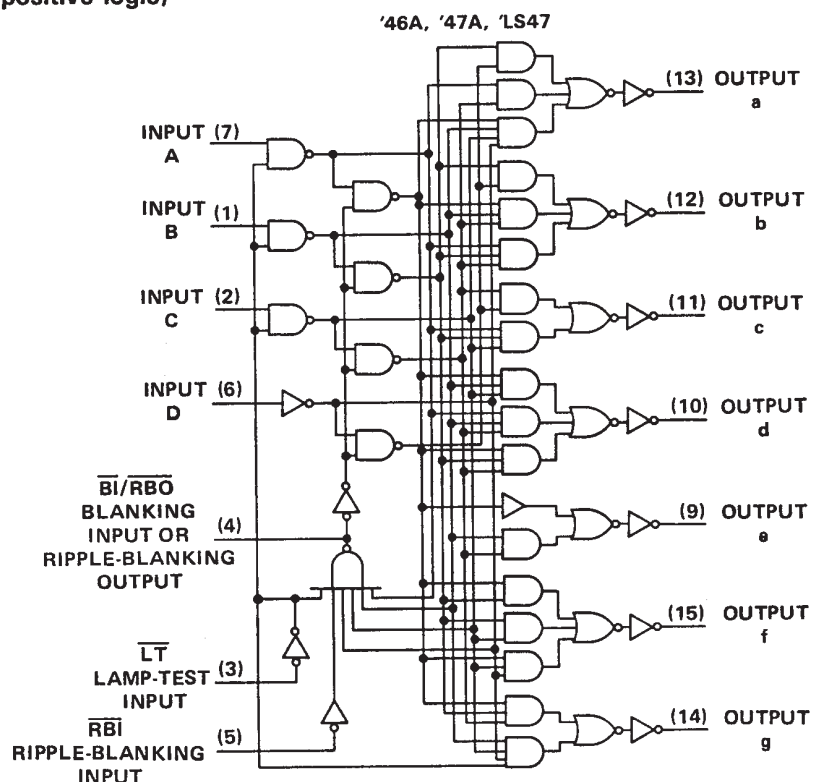
H = high level, L = low level, X = irrelevant

- 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.
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.

SN5446A, '47A, '48, SN54LS47, 'LS48, 'LS49  
SN7446A, '47A, '48, SN74LS47, 'LS48, 'LS49  
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logic diagrams (positive logic)



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

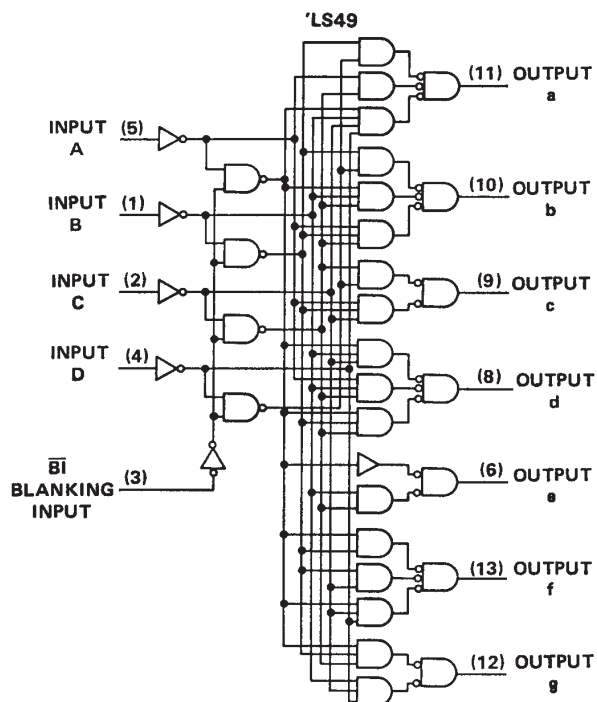


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SN5446A, '47A, '48, SN54LS47, 'LS48, 'LS49  
SN7446A, '47A, '48, SN74LS47, 'LS48, 'LS49  
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logic diagrams (continued)



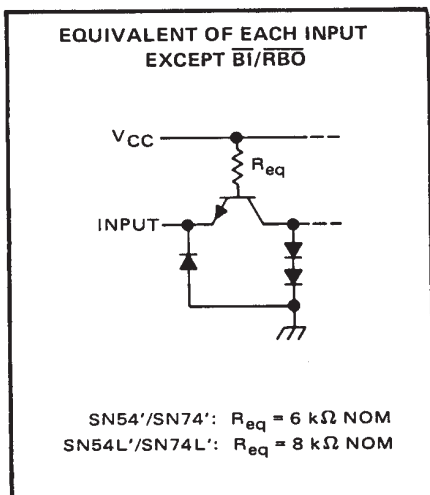
Pin numbers shown are for D, J, N, and W packages.

SN5446A, '47A, '48, SN54LS47, 'LS48, 'LS49  
 SN7446A, '47A, '48, SN74LS47, 'LS48, 'LS49  
 BCD-TO-SEVEN-SEGMENT DECODERS/DRIVERS

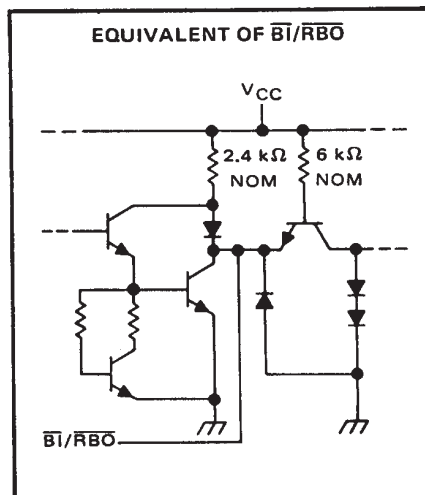
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schematics of inputs and outputs

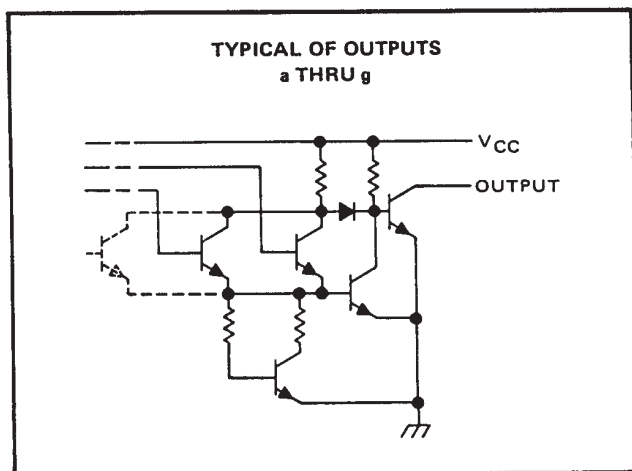
'46A, '47A, '48



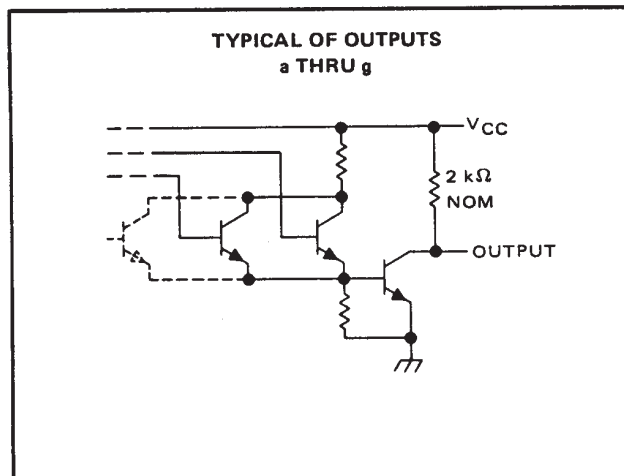
'46A, '47A, '48



'46A, '47A



'48



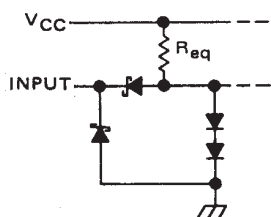
SN5446A, '47A, '48, SN54LS47, 'LS48, 'LS49  
 SN7446A, '47A, '48, SN74LS47, 'LS48, 'LS49  
 BCD-TO-SEVEN-SEGMENT DECODERS/DRIVERS

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schematics of inputs and outputs

'LS47, 'LS48, 'LS49

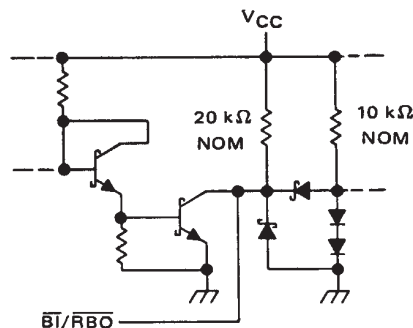
EQUIVALENT OF EACH INPUT  
 EXCEPT  $\overline{\text{BI}}/\text{RBO}$



$\overline{\text{LT}}$  and  $\overline{\text{RB}}\overline{\text{I}}$  ('LS47, 'LS48):  $R_{eq} = 20 \text{ k}\Omega \text{ NOM}$   
 $\overline{\text{BI}}$  ('LS49):  $R_{eq} = 20 \text{ k}\Omega \text{ NOM}$   
 A, B, C, and D:  $R_{eq} = 25 \text{ k}\Omega \text{ NOM}$

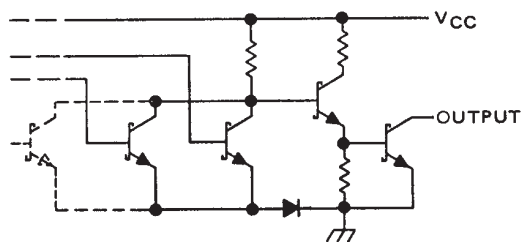
'LS47, 'LS48, 'LS49

EQUIVALENT OF  $\overline{\text{BI}}/\text{RBO}$



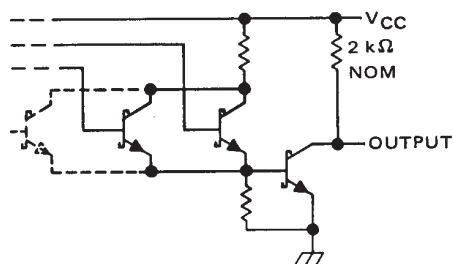
'LS47

TYPICAL OF OUTPUTS  
 a THRU g



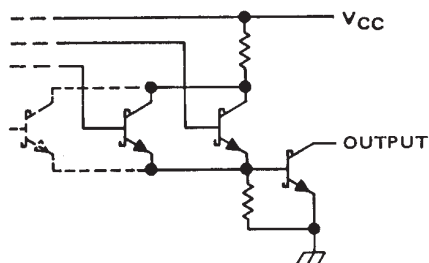
'LS48

TYPICAL OF OUTPUTS  
 a THRU g



'LS49

TYPICAL OF OUTPUTS  
 a THRU g



SN5446A, '47A, '48, SN54LS47, 'LS48, 'LS49  
SN7446A, '47A, '48, SN74LS47, 'LS48, 'LS49  
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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                                          | 5.5 V          |
| Current forced into any output in the off state        | 1 mA           |
| Operating free-air temperature range: SN5446A, SN5447A | –55°C to 125°C |
| SN7446A, SN7447A                                       | 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

|                                        |                                | SN5446A |     |      | SN5447A |     |      | SN7446A |     |      | SN7447A |     |      | 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 | μA   |
| 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   | 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              | $\overline{BI}/\overline{RBO}$<br>$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V},$<br>$V_{IL} = 0.8 \text{ V}, I_{OH} = -200 \text{ μA}$ |       | 2.4 | 3.7  |      | V    |
| $V_{OL}$     | Low-level output voltage               | $\overline{BI}/\overline{RBO}$<br>$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V},$<br>$V_{IL} = 0.8 \text{ V}, I_{OL} = 8 \text{ mA}$    |       |     | 0.27 | 0.4  | V    |
| $I_{O(off)}$ | Off-state output current               | a thru g<br>$V_{CC} = \text{MAX}, V_{IH} = 2 \text{ V},$<br>$V_{IL} = 0.8 \text{ V}, V_{O(off)} = \text{MAX}$                        |       |     |      | 250  | μA   |
| $V_{O(on)}$  | On-state output voltage                | a thru g<br>$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V},$<br>$V_{IL} = 0.8 \text{ V}, I_{O(on)} = 40 \text{ mA}$                      |       |     | 0.3  | 0.4  | V    |
| $I_I$        | Input current at maximum input voltage | Any input except $\overline{BI}/\overline{RBO}$<br>$V_{CC} = \text{MAX}, V_I = 5.5 \text{ V}$                                        |       |     |      | 1    | mA   |
| $I_{IH}$     | High-level input current               | Any input except $\overline{BI}/\overline{RBO}$<br>$V_{CC} = \text{MAX}, V_I = 2.4 \text{ V}$                                        |       |     |      | 40   | μA   |
| $I_{IL}$     | Low-level input current                | Any input except $\overline{BI}/\overline{RBO}$<br>$V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$                                        |       |     |      | –1.6 | mA   |
|              |                                        | $\overline{BI}/\overline{RBO}$                                                                                                       |       |     |      | –4   |      |
| $I_{OS}$     | Short-circuit output current           | $\overline{BI}/\overline{RBO}$<br>$V_{CC} = \text{MAX}$                                                                              |       |     |      | –4   | mA   |
| $I_{CC}$     | Supply current                         | $V_{CC} = \text{MAX},$                                                                                                               | SN54' |     |      | 64   | mA   |
|              |                                        | See Note 2                                                                                                                           | SN74' |     |      | 64   |      |

†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                | $C_L = 15 \text{ pF}, R_L = 120 \Omega,$<br>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.



**SN5446A, '47A, '48, SN54LS47, 'LS48, 'LS49  
SN7446A, '47A, '48, SN74LS47, 'LS48, 'LS49  
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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                                | 5.5 V          |
| Operating free-air temperature range: SN5448 | –55°C to 125°C |
| SN7448                                       | 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**

|                                       |                                | SN5448 |     |     | SN7448 |     |      | UNIT    |
|---------------------------------------|--------------------------------|--------|-----|-----|--------|-----|------|---------|
|                                       |                                | MIN    | NOM | MAX | MIN    | NOM | MAX  |         |
| Supply voltage, $V_{CC}$              |                                | 4.5    | 5   | 5.5 | 4.75   | 5   | 5.25 | V       |
| High-level output current, $I_{OH}$   | a thru g                       | —400   |     |     | —400   |     |      | $\mu$ A |
|                                       | $\overline{BI}/\overline{RBO}$ | —200   |     |     | —200   |     |      |         |
| Low-level output current, $I_{OL}$    | a thru g                       | 6.4    |     |     | 6.4    |     |      | mA      |
|                                       | $\overline{BI}/\overline{RBO}$ | 8      |     |     | 8      |     |      |         |
| Operating free-air temperature, $T_A$ |                                | —55    |     |     | 0      |     |      | °C      |

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

| PARAMETER       |                                        |                                                                  | TEST CONDITIONS†                                                                                |        | MIN  | TYP‡ | MAX  | UNIT |
|-----------------|----------------------------------------|------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|--------|------|------|------|------|
| V <sub>IH</sub> | High-level input voltage               |                                                                  |                                                                                                 |        | 2    |      |      | V    |
| V <sub>IL</sub> | Low-level input voltage                |                                                                  |                                                                                                 |        |      |      | 0.8  | V    |
| V <sub>IK</sub> | Input clamp voltage                    |                                                                  | V <sub>CC</sub> = MIN, I <sub>I</sub> = −12 mA                                                  |        |      |      | −1.5 | V    |
| V <sub>OH</sub> | High-level output voltage              | a thru g                                                         | V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V,                                                   |        | 2.4  | 4.2  |      | V    |
|                 |                                        | $\overline{\text{BI}}/\overline{\text{RBO}}$                     | V <sub>IL</sub> = 0.8 V, I <sub>OH</sub> = MAX                                                  |        | 2.4  | 3.7  |      |      |
| I <sub>O</sub>  | Output current                         | a thru g                                                         | V <sub>CC</sub> = MIN, V <sub>O</sub> = 0.85 V,<br>Input conditions as for V <sub>OH</sub>      |        | −1.3 | −2   |      | mA   |
| V <sub>OL</sub> | Low-level output voltage               |                                                                  | V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V,<br>V <sub>IL</sub> = 0.8 V, I <sub>OL</sub> = MAX |        | 0.27 |      | 0.4  | V    |
| I <sub>I</sub>  | Input current at maximum input voltage | Any input<br>except $\overline{\text{BI}}/\overline{\text{RBO}}$ | V <sub>CC</sub> = MAX, V <sub>I</sub> = 5.5 V                                                   |        |      |      | 1    | mA   |
| I <sub>IH</sub> | High-level input current               | Any input<br>except $\overline{\text{BI}}/\overline{\text{RBO}}$ | V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.4 V                                                   |        |      |      | 40   | μA   |
| I <sub>IL</sub> | Low-level input current                | Any input<br>except $\overline{\text{BI}}/\overline{\text{RBO}}$ | V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.4 V                                                   |        |      |      | −1.6 | mA   |
|                 |                                        | $\overline{\text{BI}}/\overline{\text{RBO}}$                     |                                                                                                 |        |      |      | −4   |      |
| I <sub>OS</sub> | Short-circuit output current           | $\overline{\text{BI}}/\overline{\text{RBO}}$                     | V <sub>CC</sub> = MAX                                                                           |        |      |      | −4   | mA   |
| I <sub>CC</sub> | Supply current                         | V <sub>CC</sub> = MAX,<br>See Note 2                             |                                                                                                 | SN5448 | 53   |      | 76   | mA   |
|                 |                                        |                                                                  |                                                                                                 | SN7448 | 53   |      | 90   |      |

† 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 |
|-----------|------------------------------------------------------------------------------|-----|-----|-----|------|
| $t_{PHL}$ | Propagation delay time, high-to-low-level output from A input                |     |     | 100 | ns   |
| $t_{PLH}$ | Propagation delay time, low-to-high-level output from A input                |     |     | 100 |      |
| $t_{PHL}$ | Propagation delay time, high-to-low-level output from $\overline{RBI}$ input |     |     | 100 | ns   |
| $t_{PLH}$ | Propagation delay time, low-to-high-level output from $\overline{RBI}$ input |     |     | 100 |      |

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



SN5446A, '47A, '48, SN54LS47, 'LS48, 'LS49  
SN7446A, '47A, '48, SN74LS47, 'LS48, 'LS49  
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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                                            |
| 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: SN54LS47                  | $-55^{\circ}\text{C}$ to $125^{\circ}\text{C}$ |
| SN74LS47                                                        | $0^{\circ}\text{C}$ to $70^{\circ}\text{C}$    |
| Storage temperature range                                       | $-65^{\circ}\text{C}$ to $150^{\circ}\text{C}$ |

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

**recommended operating conditions**

|                                        |                                | SN54LS47 |     |     | SN74LS47 |     |      | 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  |          |     | 15   | V                  |
| On-state output current, $I_{O(on)}$   | a thru g                       |          |     | 12  |          |     | 24   | mA                 |
| High-level output current, $I_{OH}$    | $\overline{BI}/\overline{RBO}$ |          |     | -50 |          |     | -50  | $\mu\text{A}$      |
| Low-level output current, $I_{OL}$     | $\overline{BI}/\overline{RBO}$ |          |     | 1.6 |          |     | 3.2  | 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†                                                                                                                                                      | SN54LS47 |      |      | SN74LS47 |      |      | 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              | $\overline{BI}/\overline{RBO}$<br>$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V},$<br>$V_{IL} = V_{IL \text{ max}}, I_{OH} = -50 \mu\text{A}$                             | 2.4      | 4.2  |      | 2.4      | 4.2  |      | V             |
| $V_{OL}$     | Low-level output voltage               | $\overline{BI}/\overline{RBO}$<br>$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V},$<br>$V_{IL} = V_{IL \text{ max}}, I_{OL} = 1.6 \text{ mA}$<br>$I_{OL} = 3.2 \text{ mA}$ | 0.25     | 0.4  |      | 0.25     | 0.4  | 0.5  | V             |
| $I_{O(off)}$ | Off-state output current               | a thru g<br>$V_{CC} = \text{MAX}, V_{IH} = 2 \text{ V},$<br>$V_{IL} = V_{IL \text{ max}}, V_{O(off)} = 15 \text{ V}$                                                  |          |      | 250  |          |      | 250  | $\mu\text{A}$ |
| $V_{O(on)}$  | On-state output voltage                | a thru g<br>$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V},$<br>$V_{IL} = V_{IL \text{ max}}, I_{O(on)} = 12 \text{ mA}$<br>$I_{O(on)} = 24 \text{ mA}$                   | 0.25     | 0.4  |      | 0.25     | 0.4  | 0.5  | 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   | $\mu\text{A}$ |
| $I_{IL}$     | Low-level input current                | Any input except $\overline{BI}/\overline{RBO}$<br>$\overline{BI}/\overline{RBO}$<br>$V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$                                       |          |      | -0.4 |          |      | -0.4 | mA            |
|              |                                        |                                                                                                                                                                       |          |      | -1.2 |          |      | -1.2 |               |
| $I_{OS}$     | Short-circuit output current           | $\overline{BI}/\overline{RBO}$<br>$V_{CC} = \text{MAX}$                                                                                                               | -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                                     |     |     | 100 |      |
| $t_{off}$ | Turn-off time from $\overline{RBI}$ input, outputs (a-f) only |     |     | 100 | ns   |
| $t_{on}$  | Turn-on time from $\overline{RBI}$ input, outputs (a-f) only  |     |     | 100 |      |

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



**SN5446A, '47A, '48, SN54LS47, 'LS48, 'LS49  
SN7446A, '47A, '48, SN74LS47, 'LS48, 'LS49  
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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: SN54LS48 | –55°C to 125°C |
| SN74LS48                                       | 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

|                                       |                                | SN54LS48 |     |     | SN74LS48 |     |      | UNIT    |
|---------------------------------------|--------------------------------|----------|-----|-----|----------|-----|------|---------|
|                                       |                                | MIN      | NOM | MAX | MIN      | NOM | MAX  |         |
| Supply voltage, $V_{CC}$              |                                | 4.5      | 5   | 5.5 | 4.75     | 5   | 5.25 | V       |
| High-level output current, $I_{OH}$   | a thru g                       | -100     |     |     | -100     |     |      | $\mu A$ |
|                                       | $\overline{BI}/\overline{RBO}$ | -50      |     |     | -50      |     |      |         |
| Low-level output current, $I_{OL}$    | a thru g                       | 2        |     |     | 6        |     |      | mA      |
|                                       | $\overline{BI}/\overline{RBO}$ | 1.6      |     |     | 3.2      |     |      |         |
| 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†                                                                                                                             | SN54LS48 |      |      | SN74LS48 |      |      | 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              | a thru g and $\overline{BI}/\overline{RBO}$<br>$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = V_{IL \text{ max}}, I_{OH} = \text{MAX}$ | 2.4      | 4.2  |      | 2.4      | 4.2  |      | V       |
| $I_O$     | Output current                         | a thru g<br>$V_{CC} = \text{MIN}, V_O = 0.85 \text{ V},$<br>Input conditions as for $V_{OH}$                                                 | –1.3     | –2   |      | –1.3     | –2   |      | mA      |
| $V_{OL}$  | Low-level output voltage               | a thru g<br>$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = V_{IL \text{ max}}, I_{OL} = 2 \text{ mA}$                                  |          | 0.25 | 0.4  |          | 0.25 | 0.4  | V       |
|           |                                        | $I_{OL} = 6 \text{ mA}$                                                                                                                      |          |      |      |          | 0.35 | 0.5  |         |
|           | $\overline{BI}/\overline{RBO}$         | $V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = V_{IL \text{ max}}, I_{OL} = 1.6 \text{ mA}$                                            |          | 0.25 | 0.4  |          | 0.25 | 0.4  | V       |
|           |                                        | $I_{OL} = 3.2 \text{ mA}$                                                                                                                    |          |      |      |          | 0.35 | 0.5  |         |
| $I_I$     | Input current at maximum input voltage | Any input except $\overline{BI}/\overline{RBO}$<br>$V_{CC} = \text{MAX}, V_I = 7 \text{ V}$                                                  |          |      | 0.1  |          |      | 0.1  | mA      |
| $I_{IH}$  | High-level input current               | Any input except $\overline{BI}/\overline{RBO}$<br>$V_{CC} = \text{MAX}, V_I = 2.7 \text{ V}$                                                |          |      | 20   |          |      | 20   | $\mu$ A |
| $I_{IL}$  | Low-level input current                | Any input except $\overline{BI}/\overline{RBO}$<br>$V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$                                                |          |      | –0.4 |          |      | –0.4 | mA      |
|           |                                        | $\overline{BI}/\overline{RBO}$                                                                                                               |          |      | –1.2 |          |      | –1.2 |         |
| $I_{OS}$  | Short-circuit output current           | $\overline{BI}/\overline{RBO}$<br>$V_{CC} = \text{MAX}$                                                                                      | –0.3     |      | –2   | –0.3     |      | –2   | mA      |
| $I_{CC}$  | Supply current                         | $V_{CC} = \text{MAX},$ See Note 2                                                                                                            |          | 25   | 38   |          | 25   | 38   | 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 |
|---------------------------------------------------------------------------------------------------|-------------------------------------------------|-----|-----|-----|------|
| $t_{PHL}$ Propagation delay time, high-to-low-level output from A input                           | $C_L = 15 \text{ pF}, R_L = 4 \text{ k}\Omega,$ |     | 100 |     | ns   |
| $t_{PLH}$ Propagation delay time, low-to-high-level output from A input                           | See Note 3                                      |     | 100 |     |      |
| $t_{PHL}$ Propagation delay time, high-to-low-level output (a-f only) from $\overline{RBI}$ input | $C_L = 15 \text{ pF}, R_L = 6 \text{ k}\Omega,$ |     | 100 |     | ns   |
| $t_{PLH}$ Propagation delay time, low-to-high-level output (a-f only) from $\overline{RBI}$ input | See Note 3                                      |     | 100 |     |      |

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



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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            |
| Current forced into any output in the off state | 1 mA           |
| Operating free-air temperature range: SN54LS49  | –55°C to 125°C |
| SN74LS49                                        | 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

|                                       | SN54LS49 |     |     | SN74LS49 |     |      | UNIT |
|---------------------------------------|----------|-----|-----|----------|-----|------|------|
|                                       | MIN      | NOM | MAX | MIN      | NOM | MAX  |      |
| Supply voltage, $V_{CC}$              | 4.5      | 5   | 5.5 | 4.75     | 5   | 5.25 | V    |
| High-level output voltage, $V_{OH}$   |          |     | 5.5 |          |     | 5.5  | V    |
| Low-level output current, $I_{OL}$    |          |     | 4   |          |     | 8    | mA   |
| Operating free-air temperature, $T_A$ | –55      |     | 125 | 0        |     | 70   | °C   |

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

| PARAMETER       |                                        | TEST CONDITIONS†                                                                                             | SN54LS49               |          | SN74LS49 |          | UNIT |   |
|-----------------|----------------------------------------|--------------------------------------------------------------------------------------------------------------|------------------------|----------|----------|----------|------|---|
|                 |                                        |                                                                                                              | MIN                    | TYP‡ MAX | MIN      | TYP‡ MAX |      |   |
| V <sub>IH</sub> | High-level input voltage               |                                                                                                              | 2                      |          | 2        |          | V    |   |
| V <sub>IL</sub> | Low-level input voltage                |                                                                                                              |                        | 0.7      |          | 0.8      | V    |   |
| V <sub>IK</sub> | Input clamp voltage                    | V <sub>CC</sub> = MIN, I <sub>I</sub> = −18 mA                                                               |                        | −1.5     |          | −1.5     | V    |   |
| I <sub>OH</sub> | High-level output current              | V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = V <sub>IL</sub> max, V <sub>OH</sub> = 5.5 V |                        | 250      |          | 250      | μA   |   |
| V <sub>OL</sub> | Low-level output voltage               | V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = V <sub>IL</sub> max                          | I <sub>OL</sub> = 4 mA | 0.25     | 0.4      | 0.25     | 0.4  | V |
|                 |                                        | I <sub>OL</sub> = 8 mA                                                                                       |                        |          | 0.35     | 0.5      |      |   |
| I <sub>I</sub>  | Input current at maximum input voltage | V <sub>CC</sub> = MAX, V <sub>I</sub> = 7 V                                                                  |                        | 0.1      |          | 0.1      | mA   |   |
| I <sub>IH</sub> | High-level input current               | V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.7 V                                                                |                        | 20       |          | 20       | μA   |   |
| I <sub>IL</sub> | Low-level input current                | V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.4 V                                                                |                        | −0.4     |          | −0.4     | mA   |   |
| I <sub>CC</sub> | Supply current                         | V <sub>CC</sub> = MAX, See Note 2                                                                            | 8                      | 15       | 8        | 15       | 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 |
|---------------------------------------------------------------------------------------------------|-----------------------------------------------------|-----|-----|-----|------|
| $t_{PHL}$ Propagation delay time, high-to-low-level output from A input                           | $C_L = 15 \text{ pF}$ , $R_L = 4 \text{ k}\Omega$ , |     |     | 100 | ns   |
| $t_{PLH}$ Propagation delay time, low-to-high-level output from A input                           | See Note 3                                          |     |     | 100 |      |
| $t_{PHL}$ Propagation delay time, high-to-low-level output (a-f only) from $\overline{RBI}$ input | $C_L = 15 \text{ pF}$ , $R_L = 6 \text{ k}\Omega$ , |     |     | 100 | ns   |
| $t_{PLH}$ Propagation delay time, low-to-high-level output (a-f only) from $\overline{RBI}$ input | See Note 3                                          |     |     | 100 |      |

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

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