

54LS240, 54LS241,  
54S240, 54S241  
Buffers

Military Logic Products

'240 Octal Inverter Buffer (3-State)  
'241 Octal Buffer (3-State)  
Product Specification

FUNCTION TABLE '240

| INPUTS          |                |                 |                | OUTPUTS        |                |
|-----------------|----------------|-----------------|----------------|----------------|----------------|
| OE <sub>a</sub> | I <sub>a</sub> | OE <sub>b</sub> | I <sub>b</sub> | Y <sub>a</sub> | Y <sub>b</sub> |
| L               | L              | L               | L              | H              | H              |
| L               | H              | L               | H              | L              | L              |
| H               | X              | H               | X              | (Z)            | (Z)            |

H = High voltage level  
L = Low voltage level  
X = Don't care  
(Z) = High impedance (off) state

FUNCTION TABLE '241

| INPUTS          |                |                 |                | OUTPUTS        |                |
|-----------------|----------------|-----------------|----------------|----------------|----------------|
| OE <sub>a</sub> | I <sub>a</sub> | OE <sub>b</sub> | I <sub>b</sub> | Y <sub>a</sub> | Y <sub>b</sub> |
| L               | L              | H               | L              | L              | L              |
| L               | H              | H               | H              | H              | H              |
| H               | X              | L               | X              | (Z)            | (Z)            |

H = High voltage level  
L = Low voltage level  
X = Don't care  
(Z) = High impedance (off) state

ORDERING INFORMATION

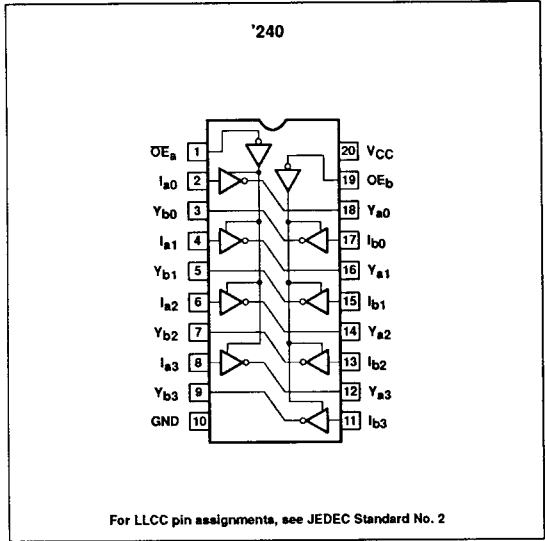
| DESCRIPTION             | ORDER CODE                                             |
|-------------------------|--------------------------------------------------------|
| 20-Pin Ceramic DIP      | 54LS240/BRA<br>54S240/BRA<br>54LS241/BRA<br>54S241/BRA |
| 20-Pin Ceramic FlatPack | 54LS240/BSA<br>54S240/BSA<br>54LS241/BSA<br>54S241/BSA |
| 20-Pin Ceramic LLCC     | 54LS240/B2A<br>54S240/B2A<br>54LS241/B2A<br>54S241/B2A |

INPUT AND OUTPUT LOADING AND FAN-OUT TABLE

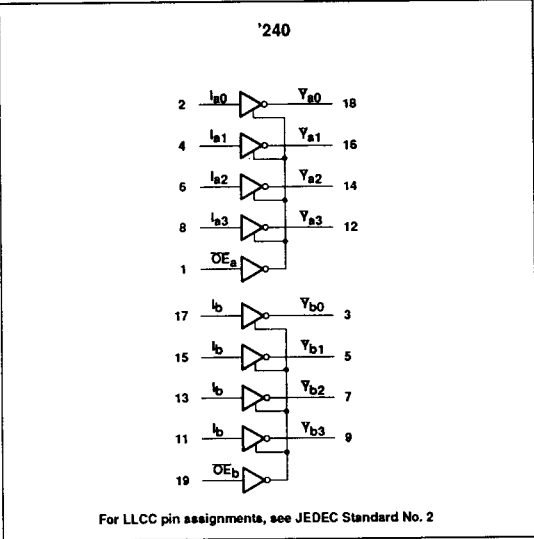
| PINS                                                                  | DESCRIPTION | 54S   | 54LS   |
|-----------------------------------------------------------------------|-------------|-------|--------|
| I <sub>a0</sub> - I <sub>a3</sub> , I <sub>b0</sub> - I <sub>b3</sub> | Inputs      | 1SUL  | 1LSUL  |
| OE <sub>a</sub> , OE <sub>b</sub> , OE <sub>c</sub>                   | Inputs      | 1SUL  | 1LSUL  |
| All                                                                   | Outputs     | 24SUL | 32LSUL |

NOTE: A 54S Unit Load (SUL) is 50μA I<sub>IH</sub>, and -2.0mA I<sub>IL</sub> and a 54LS Unit Load (LSUL) is 20μA I<sub>IH</sub> and -0.4mA I<sub>IL</sub>.

PIN CONFIGURATION



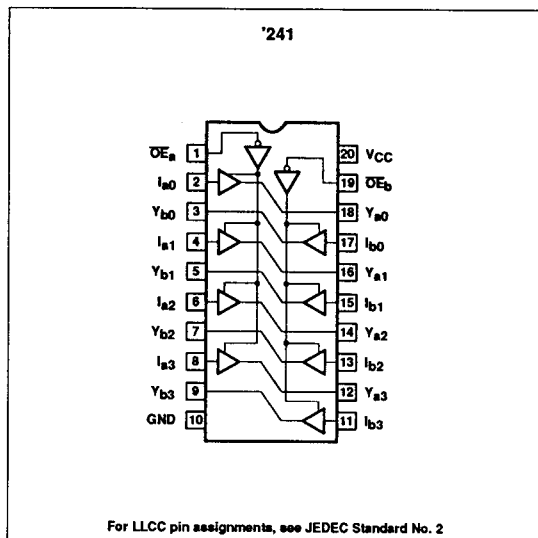
LOGIC SYMBOL



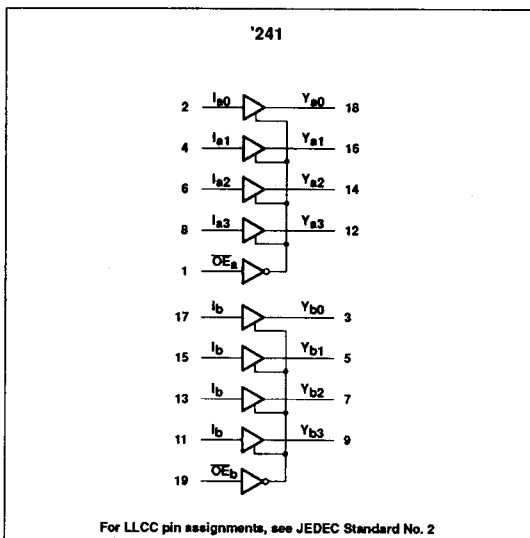
## Buffers

## 54LS240, 54LS241, 54S240, 54S241

## PIN CONFIGURATION



## LOGIC SYMBOL



## ABSOLUTE MAXIMUM RATINGS (Over operating free-air temperature range unless otherwise noted.)

| SYMBOL    | PARAMETER                                            | 54LS             | 54S              | UNIT |
|-----------|------------------------------------------------------|------------------|------------------|------|
| $V_{CC}$  | Supply voltage                                       | 7.0              | 7.0              | V    |
| $V_I$     | Input voltage range                                  | -0.5 to +7.0     | -0.5 to +5.5     | V    |
| $I_I$     | Input current range                                  | -30 to +1        | -30 to +5        | mA   |
| $V_O$     | Voltage applied to output in High output state range | -0.5 to $V_{CC}$ | -0.5 to $V_{CC}$ | V    |
| $T_{STG}$ | Storage temperature range                            | -65 to +150      | -65 to +150      | °C   |

## RECOMMENDED OPERATING CONDITIONS

| SYMBOL   | PARAMETER                            | 54LS |     |      | 54S |     |      | UNIT |
|----------|--------------------------------------|------|-----|------|-----|-----|------|------|
|          |                                      | Min  | Nom | Max  | Min | Nom | Max  |      |
| $V_{CC}$ | Supply voltage                       | 4.5  | 5.0 | 5.5  | 4.5 | 5.0 | 5.5  | V    |
| $V_{IH}$ | High-level input voltage             | 2.0  |     |      | 2.0 |     |      | V    |
| $V_{IL}$ | Low-level input voltage              |      |     | +0.7 |     |     | +0.8 | V    |
|          |                                      |      |     | +0.7 |     |     | +0.7 | V    |
| $I_{IK}$ | Input clamp current                  |      |     | -18  |     |     | -18  | mA   |
| $I_{OH}$ | High-level output current            |      |     | -12  |     |     | -12  | mA   |
| $I_{OL}$ | Low-level output current             |      |     | 12   |     |     | 48   | mA   |
| $T_A$    | Operating free-air temperature range | -55  |     | +125 | -55 |     | +125 | °C   |

**Buffers****54LS240, 54LS241, 54S240, 54S241****DC ELECTRICAL CHARACTERISTICS** (Over recommended operating free-air temperature range unless otherwise noted.)

| SYMBOL       | PARAMETER                                           | TEST CONDITIONS <sup>1</sup>                                                                                  | 54LS240, 241 |                  |      | 54S240, 241 |                  |      | UNIT          |
|--------------|-----------------------------------------------------|---------------------------------------------------------------------------------------------------------------|--------------|------------------|------|-------------|------------------|------|---------------|
|              |                                                     |                                                                                                               | Min          | Typ <sup>2</sup> | Max  | Min         | Typ <sup>2</sup> | Max  |               |
| $\Delta V_T$ | Hysteresis ( $V_{T+} - V_{T-}$ ) <sup>6</sup>       | $V_{CC} = \text{Min}$                                                                                         | 0.2          | 0.4              |      | 0.2         | 0.4              |      | V             |
| $V_{OH}$     | High-level output voltage                           | $V_{CC} = \text{Min}, V_{IH} = \text{Min}, V_{IL} = \text{Max}, I_{OH} = \text{Max}$                          | 2.0          |                  |      | 2.0         |                  |      | V             |
|              |                                                     | $V_{CC} = \text{Min}, V_{IH} = \text{Min}, V_{IL} = \text{Max}, I_{OH} = -3\text{mA}$                         | 2.4          | 3.4              |      | 2.4         | 3.4              |      | V             |
| $V_{OL}$     | Low-level output voltage                            | $V_{CC} = \text{Min}, V_{IH} = \text{Min}, V_{IL} = \text{Max}, I_{OL} = \text{Max}$                          |              |                  | 0.4  |             |                  | 0.55 | V             |
| $V_{IK}$     | Input clamp voltage                                 | $V_{CC} = \text{Min}, I_I = I_{IK}$                                                                           |              |                  | -1.5 |             |                  | -1.2 | V             |
| $I_{OZH}$    | Offstate output current, High-level voltage applied | $V_{CC} = \text{Max}, V_{IH} = \text{Min}, V_{IL} = \text{Max}$<br>$V_O = 2.4\text{V}$<br>$V_O = 2.7\text{V}$ |              |                  |      |             |                  | 50   | $\mu\text{A}$ |
| $I_{OZL}$    | Offstate output current, Low-level voltage applied  | $V_{CC} = \text{Max}, V_{IH} = \text{Min}, V_{IL} = \text{Max}$<br>$V_O = 2.4\text{V}$<br>$V_O = 0.5\text{V}$ |              |                  | -20  |             |                  | -50  | $\mu\text{A}$ |
| $I_{IH2}$    | Input current at maximum input voltage              | $V_{CC} = \text{Max}$<br>$V_I = 5.5\text{V}$<br>$V_I = 7.0\text{V}$                                           |              |                  | 0.1  |             |                  | 1.0  | mA            |
| $I_{IH1}$    | High-level input current                            | $V_{CC} = \text{Max}, V_I = 2.7\text{V}$                                                                      |              |                  | 20   |             |                  | 50   | $\mu\text{A}$ |
| $I_{IL}$     | Low-level input current                             | $V_{CC} = \text{Max}$<br>$V_I = 0.4\text{V}$                                                                  |              |                  | -0.2 |             |                  |      | mA            |
|              |                                                     | $V_{CC} = \text{Max}$<br>$V_I = 0.5\text{V}$<br>$I_{A0} - I_{A3}, I_{B0} - I_{B3}$ inputs                     |              |                  |      |             |                  | -400 | $\mu\text{A}$ |
|              |                                                     | $V_{CC} = \text{Max}$<br>$V_I = 0.5\text{V}$<br>$OE_A, OE_B, OE_C$ inputs                                     |              |                  |      |             |                  | -2   | mA            |
| $I_{OS}$     | Short-circuit output current <sup>3</sup>           | $V_{CC} = \text{Max}$                                                                                         | -40          |                  | -130 | -80         |                  | -180 | mA            |
| $I_{CC}$     | Supply current <sup>4</sup> (total)                 | $V_{CC} = \text{Max}$                                                                                         | $I_{CCH}$    | 'LS240           | 17   | 27          |                  |      | mA            |
|              |                                                     |                                                                                                               | $I_{CCL}$    |                  | 26   | 44          |                  |      | mA            |
|              |                                                     |                                                                                                               | $I_{CCZ}$    |                  | 29   | 60          |                  |      | mA            |
|              |                                                     |                                                                                                               | $I_{CCH}$    | 'LS241           | 17   | 27          |                  |      | mA            |
|              |                                                     |                                                                                                               | $I_{CCL}$    |                  | 27   | 46          |                  |      | mA            |
|              |                                                     |                                                                                                               | $I_{CCZ}$    |                  | 32   | 54          |                  |      | mA            |
|              |                                                     |                                                                                                               | $I_{CCH}$    | 'S240            |      |             | 80               | 123  | mA            |
|              |                                                     |                                                                                                               | $I_{CCL}$    |                  |      |             | 100              | 145  | mA            |
|              |                                                     |                                                                                                               | $I_{CCZ}$    |                  |      |             | 100              | 145  | mA            |
|              |                                                     |                                                                                                               | $I_{CCH}$    | 'S241            |      |             | 95               | 147  | mA            |
|              |                                                     |                                                                                                               | $I_{CCL}$    |                  |      |             | 120              | 170  | mA            |
|              |                                                     |                                                                                                               | $I_{CCZ}$    |                  |      |             | 120              | 170  | mA            |

**Buffers****54LS240, 54LS241, 54S240, 54S241****AC ELECTRICAL CHARACTERISTICS**  $T_A = 25^\circ\text{C}$ ,  $V_{CC} = 5.0\text{V}$ 

| SYMBOL                               | PARAMETER         | TEST CONDITIONS                               |       | 54LS                  |          | 54S                   |        | UNIT     |
|--------------------------------------|-------------------|-----------------------------------------------|-------|-----------------------|----------|-----------------------|--------|----------|
|                                      |                   |                                               |       | C <sub>L</sub> = 50pF |          | C <sub>L</sub> = 50pF |        |          |
|                                      |                   |                                               |       | Min                   | Max      | Min                   | Max    |          |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation delay | Waveform 1, '240                              |       |                       | 14<br>18 |                       | 7<br>7 | ns<br>ns |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation delay | Waveform 2, '241                              |       |                       | 18<br>18 |                       | 9<br>9 | ns<br>ns |
| t <sub>PZH</sub>                     | Enable to High    | Waveform 3                                    | LS    |                       | 30       |                       |        | ns       |
|                                      |                   |                                               | 'S240 |                       |          |                       | 10     | ns       |
|                                      |                   |                                               | 'S241 |                       |          |                       | 12     | ns       |
| t <sub>PZL</sub>                     | Enable to Low     | Waveform 4                                    |       |                       | 30       |                       | 15     | ns       |
| t <sub>PHZ</sub>                     | Disable from High | Waveform 3, C <sub>L</sub> = 5pF <sup>5</sup> |       |                       | 18       |                       | 9      | ns       |
| t <sub>PLZ</sub>                     | Disable from Low  | Waveform 4, C <sub>L</sub> = 5pF <sup>5</sup> |       |                       | 25       |                       | 15     | ns       |
| t <sub>PHZ</sub>                     | Disable from High | Waveform 3, C <sub>L</sub> = 50pF             |       |                       | 34       |                       | 14     | ns       |
| t <sub>PLZ</sub>                     | Disable from Low  | Waveform 4, C <sub>L</sub> = 50pF             |       |                       | 27       |                       | 16.5   | ns       |

**AC ELECTRICAL CHARACTERISTICS**  $T_A = -55^\circ\text{C}$  and  $+125^\circ\text{C}$ ,  $V_{CC} = 5.0\text{V}^6$ 

| SYMBOL                 | PARAMETER         | TEST CONDITIONS                  |       | 54LS                |          | 54S                 |            | UNIT     |
|------------------------|-------------------|----------------------------------|-------|---------------------|----------|---------------------|------------|----------|
|                        |                   |                                  |       | $C_L = 50\text{pF}$ |          | $C_L = 50\text{pF}$ |            |          |
|                        |                   |                                  |       | Min                 | Max      | Min                 | Max        |          |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation delay | Waveform 1, '240                 |       |                     | 18<br>23 |                     | 9.0<br>9.0 | ns<br>ns |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation delay | Waveform 2, '241                 |       |                     | 23<br>23 |                     | 16<br>12   | ns<br>ns |
| $t_{PZH}$              | Enable to High    | Waveform 3                       | LS    |                     | 39       |                     |            | ns       |
|                        |                   |                                  | 'S240 |                     |          |                     | 13         | ns       |
|                        |                   |                                  | 'S241 |                     |          |                     | 20         | ns       |
| $t_{PZL}$              | Enable to Low     | Waveform 4                       |       |                     | 39       |                     | 20         | ns       |
| $t_{PHZ}$              | Disable from High | Waveform 3, $C_L = 5\text{pF}^5$ |       |                     | 23       |                     | 12         | ns       |
| $t_{PLZ}$              | Disable from Low  | Waveform 4, $C_L = 5\text{pF}^5$ |       |                     | 33       |                     | 20         | ns       |
| $t_{PHZ}$              | Disable from High | Waveform 3, $C_L = 50\text{pF}$  |       |                     | 44       |                     | 18         | ns       |
| $t_{PLZ}$              | Disable from Low  | Waveform 4, $C_L = 50\text{pF}$  |       |                     | 35       |                     | 22         | ns       |

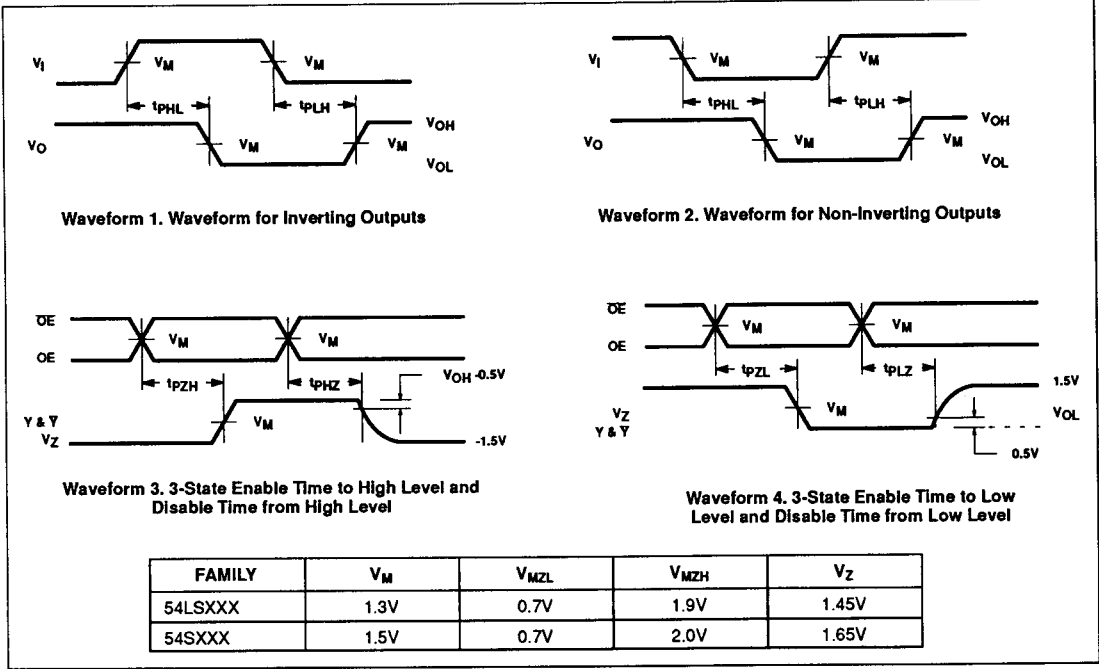
**NOTES:**

- For conditions shown as Min or Max, use the appropriate value specified under recommended operating conditions for the applicable type and function table operating mode.
- All typical values are at  $V_{CC} = 5\text{V}$ ,  $T_A = 25^\circ\text{C}$ .
- Not more than one output should be shorted at a time and duration of the short circuit should not exceed one second.
- $I_{CC}$  is measured with outputs open.
- Guaranteed by 50pF limits, but not tested.
- These parameters are guaranteed, but not tested.

Buffers

54LS240, 54LS241, 54S240, 54S241

AC WAVEFORMS



Buffers

54LS240, 54LS241, 54S240, 54S241

TEST CIRCUIT AND WAVEFORM

