

**SN54S64, SN54S65,  
SN74S64, SN74S65**  
**4-2-3-2 INPUT AND-OR-INVERT GATES**  
SDLS205 – DECEMBER 1983 – REVISED MARCH 1988

- Package Options Include Plastic "Small Outline" Packages, Ceramic Chip Carriers and Flat Packages, and Plastic and Ceramic DIPs

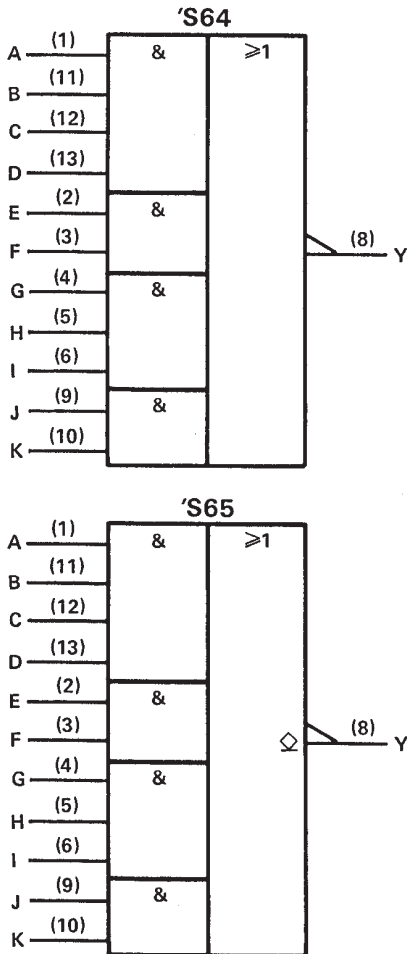
- Dependable Texas Instruments Quality and Reliability

**description**

These devices contain 4-2-3-2 input AND-OR-INVERT gates. They perform the Boolean function  $Y = \overline{ABCD + EF + GHI + JK}$ . The 'S64 has totem-pole outputs and the 'S65 has open-collector outputs.

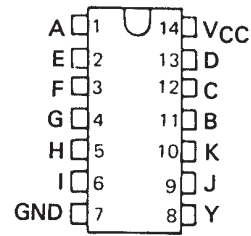
The SN54S64 and the SN54S65 are characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN74S64 and the SN74S65 are characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

**logic symbols†**

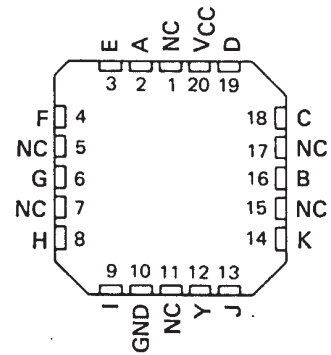


†These symbols are in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12. Pin numbers shown are for D, J, N, and W packages.

SN54S64, SN54S65 . . . J OR W PACKAGE  
SN74S64, SN74S65 . . . D OR N PACKAGE  
(TOP VIEW)

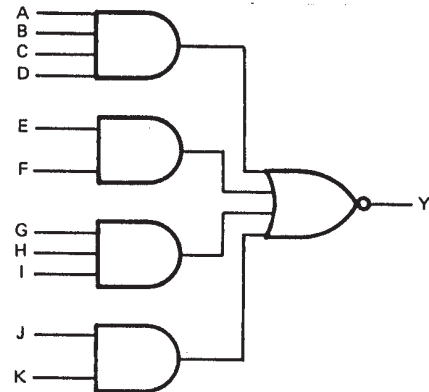


SN54S64, SN54S65 . . . FK PACKAGE  
(TOP VIEW)



NC - No internal connection

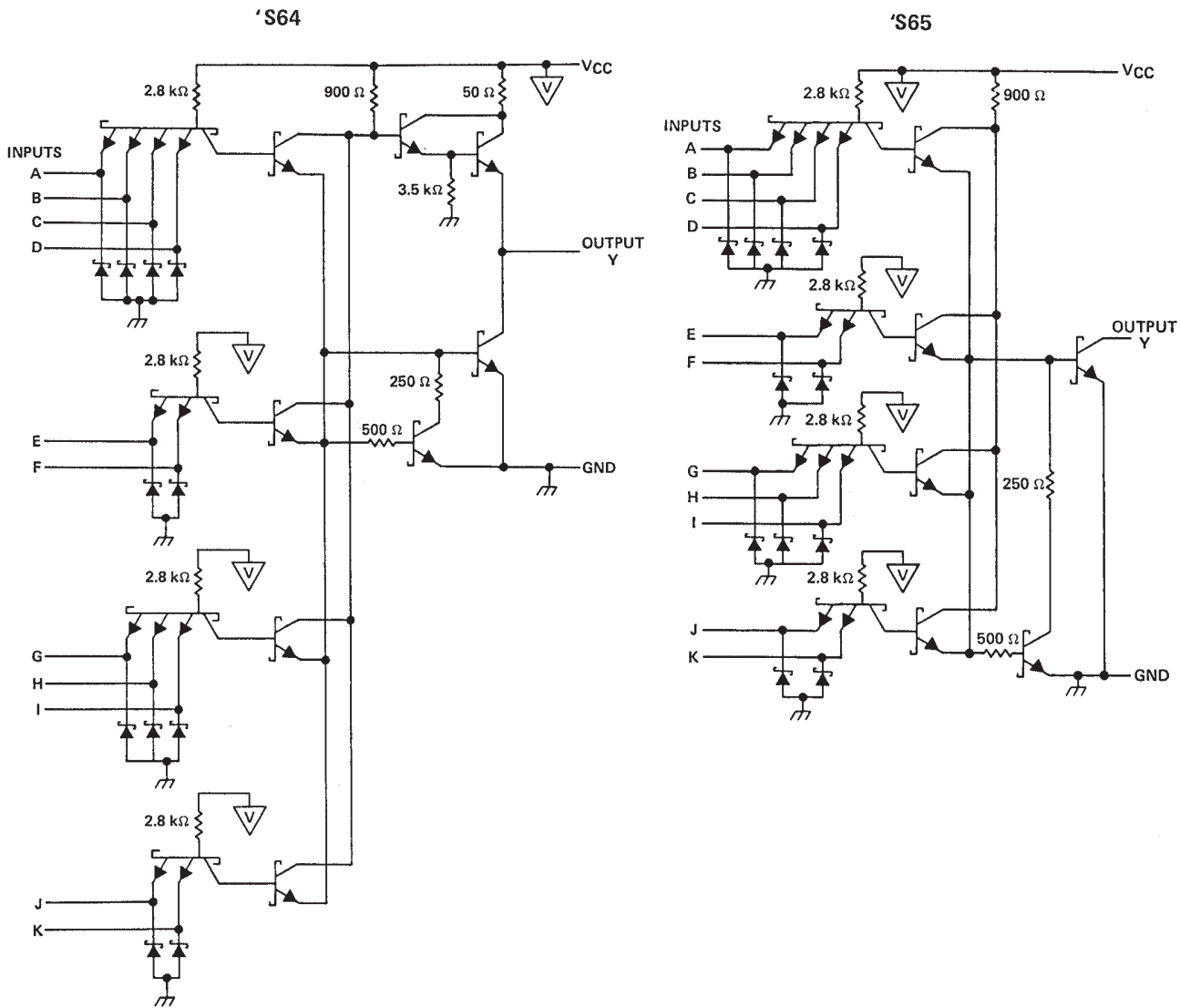
**logic diagram (each device) (positive logic)**



**SN54S64, SN54S65,  
SN74S64, SN74S65**  
**4-2-3-2 INPUT AND-OR-INVERT GATES**

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schematics (each gate)



Resistor values shown are nominal and in ohms.

**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          |
| Off-state output voltage, 'S65 .....              | 7 V            |
| Operating free-air temperature range: SN54' ..... | -55°C to 125°C |
| SN74' .....                                       | 0°C to 70°C    |
| Storage temperature range .....                   | -65°C to 150°C |



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# SN54S64, SN54S65

## 4-2-3-2 INPUT AND-OR-INVERT GATES

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### recommended operating conditions

|                                      | SN54S64 |     |     | SN74S64 |     |      | UNIT |
|--------------------------------------|---------|-----|-----|---------|-----|------|------|
|                                      | MIN     | NOM | MAX | MIN     | NOM | MAX  |      |
| $V_{CC}$ Supply voltage              | 4.5     | 5   | 5.5 | 4.75    | 5   | 5.25 | V    |
| $V_{IH}$ High-level input voltage    | 2       |     |     | 2       |     |      | V    |
| $V_{IL}$ Low-level input voltage     |         |     | 0.8 |         |     | 0.8  | V    |
| $I_{OH}$ High-level output current   |         |     | -1  |         |     | -1   | mA   |
| $I_{OL}$ Low-level output current    |         |     | 20  |         |     | 20   | mA   |
| $T_A$ Operating free-air temperature | -55     |     | 125 | 0       |     | 70   | °C   |

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

| PARAMETER  | TEST CONDITIONS †   | SN54S64 |       | SN74S64 |     | UNIT |       |     |
|------------|---|---------|-------|---------|-----|------|-------|-----|
|            |   | MIN     | TYP ‡ | MAX     | MIN |      | TYP ‡ | MAX |
| $V_{IK}$   | $V_{CC} = \text{MIN}, I_I = -18 \text{ mA}$                           |         |       | -1.2    |     | -1.2 | V     |     |
| $V_{OH}$   | $V_{CC} = \text{MIN}, V_{IL} = 0.8 \text{ V}, I_{OH} = -1 \text{ mA}$ | 2.5     | 3.4   |         | 2.7 | 3.4  | V     |     |
| $V_{OL}$   | $V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, I_{OL} = 20 \text{ mA}$   |         |       | 0.5     |     | 0.5  | V     |     |
| $I_I$      | $V_{CC} = \text{MAX}, V_I = 5.5 \text{ V}$                            |         |       | 1       |     | 1    | mA    |     |
| $I_{IH}$   | $V_{CC} = \text{MAX}, V_I = 2.7 \text{ V}$                            |         |       | 50      |     | 50   | μA    |     |
| $I_{IL}$   | $V_{CC} = \text{MAX}, V_I = 0.5 \text{ V}$                            |         |       | -2      |     | -2   | mA    |     |
| $I_{OS} §$ | $V_{CC} = \text{MAX}$   | -40     |       | -100    | -40 | -100 | mA    |     |
| $I_{CCH}$  | $V_{CC} = \text{MAX}, V_I = 0$  |         | 7     | 12.5    |     | 7    | 12.5  | mA  |
| $I_{CCL}$  | $V_{CC} = \text{MAX}, V_I = 4.5 \text{ V}$                            |         | 8.5   | 16      |     | 8.5  | 16    | mA  |

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ All typical values are at  $V_{CC} = 5 \text{ V}, T_A = 25^\circ \text{C}$ .

§ Not more than one output should be shorted at a time, and the duration of the short-circuit should not exceed one second.

### switching characteristics, $V_{CC} = 5 \text{ V}, T_A = 25^\circ \text{C}$ (see note 2)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | TEST CONDITIONS                         | MIN | TYP | MAX | UNIT |    |
|-----------|--------------|-------------|---|-----|-----|-----|------|----|
| $t_{PLH}$ | Any          | Y           | $R_L = 280 \Omega, C_L = 15 \text{ pF}$ |     | 3.5 | 5.5 | ns   |    |
| $t_{PHL}$ |              |             |   |     | 3.5 | 5.5 | ns   |    |
| $t_{PLH}$ |              |             | $R_L = 280 \Omega, C_L = 50 \text{ pF}$ |     |     | 5   |      | ns |
| $t_{PHL}$ |              |             |   |     |     | 5.5 |      | ns |

NOTE 2: Load circuits and voltage waveforms are shown in Section 1.



# SN54S65, SN54S65

## 4-2-3-2 INPUT AND-OR-INVERT GATES

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### recommended operating conditions

|   | SN54S65 |     |     | SN74S65 |     |      | UNIT |
|---|---------|-----|-----|---------|-----|------|------|
|   | MIN     | NOM | MAX | MIN     | NOM | MAX  |      |
| V <sub>CC</sub> Supply voltage                | 4.5     | 5   | 5.5 | 4.75    | 5   | 5.25 | V    |
| V <sub>IH</sub> High-level input voltage      | 2       |     |     | 2       |     |      | V    |
| V <sub>IL</sub> Low-level input voltage       |         |     | 0.8 |         |     | 0.8  | V    |
| V <sub>OH</sub> High-level output voltage     |         |     | 5.5 |         |     | 5.5  | V    |
| I <sub>OL</sub> Low-level output current      |         |     | 20  |         |     | 20   | mA   |
| T <sub>A</sub> Operating free-air temperature | -55     |     | 125 | 0       |     | 70   | °C   |

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

| PARAMETER        | TEST CONDITIONS†  | SN54S65 |      |      | SN74S65 |      |      | UNIT |
|------------------|---|---------|------|------|---------|------|------|------|
|                  |   | MIN     | TYP‡ | MAX  | MIN     | TYP‡ | MAX  |      |
| V <sub>IK</sub>  | V <sub>CC</sub> = MIN, I <sub>I</sub> = -18 mA                          |         |      | 1.2  |         |      | 1.2  | V    |
| I <sub>OH</sub>  | V <sub>CC</sub> = MIN, V <sub>IL</sub> = 0.8 V, V <sub>OH</sub> = 5.5 V |         |      |      |         |      | 0.25 | mA   |
|                  | V <sub>CC</sub> = MIN, V <sub>IL</sub> = 0.7 V, V <sub>OH</sub> = 5.5 V |         |      | 0.25 |         |      |      |      |
| V <sub>OL</sub>  | V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, I <sub>OL</sub> = 20 mA   | 0.2     | 0.4  |      | 0.2     | 0.4  |      | V    |
| I <sub>I</sub>   | V <sub>CC</sub> = MAX, V <sub>I</sub> = 5.5 V                           |         |      | 1    |         |      | 1    | mA   |
| I <sub>IH</sub>  | V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.7 V                           |         |      | 50   |         |      | 50   | μA   |
| I <sub>IL</sub>  | V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.5 V                           |         |      | -2   |         |      | -2   | mA   |
| I <sub>CCH</sub> | V <sub>CC</sub> = MAX, V <sub>I</sub> = 0                               | 6       | 11   |      | 6       | 11   |      | mA   |
| I <sub>CCL</sub> | V <sub>CC</sub> = MAX, V <sub>I</sub> = 4.5 V                           | 8.5     | 16   |      | 8.5     | 16   |      | mA   |

†For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡All typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C.

### switching characteristics, V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C (see note 2)

| PARAMETER        | FROM (INPUT) | TO (OUTPUT) | TEST CONDITIONS         |                        | MIN | TYP | MAX | UNIT |
|------------------|--------------|-------------|-------------------------|------------------------|-----|-----|-----|------|
| t <sub>PLH</sub> | Any          | Y           | R <sub>L</sub> = 280 Ω, | C <sub>L</sub> = 15 pF | 2   | 5   | 7.5 | ns   |
| t <sub>PHL</sub> |              |             |                         |                        | 2   | 5.5 | 8.5 | ns   |
| t <sub>PLH</sub> |              |             | R <sub>L</sub> = 280 Ω, | C <sub>L</sub> = 50 pF | 8   |     |     | ns   |
| t <sub>PHL</sub> |              |             |                         |                        | 6.5 |     |     | ns   |

NOTE 2: Load circuits and voltage waveforms are shown in Section 1.



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