

# SN54ALS253, SN74ALS253, SN74AS253A DUAL 1-OF-4 DATA SELECTORS/MULTIPLEXERS WITH 3-STATE OUTPUTS

SDAS216A – APRIL 1982 – REVISED DECEMBER 1994

- 3-State Versions of the 'ALS153 and SN74AS153
- Permits Multiplexing From n Lines to One Line
- Performs Parallel-to-Serial Conversion
- Package Options Include Plastic Small-Outline (D) Packages, Ceramic Chip Carriers (FK), and Standard Plastic (N) and Ceramic (J) 300-mil DIPs

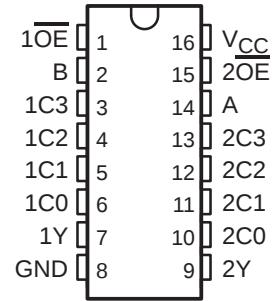
## description

These data selectors/multiplexers contain inverters and drivers to supply full binary decoding data selection to the AND-OR gates. Separate output control inputs are provided for each of the two 4-line sections.

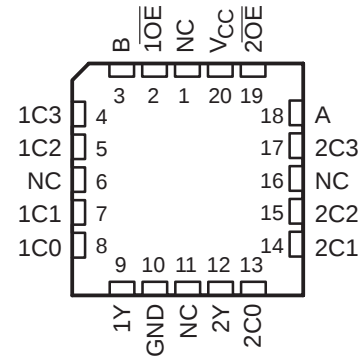
The 3-state outputs can interface with and drive data lines of bus-organized systems. With all but one of the common outputs disabled (at a high-impedance state), the low impedance of the single enabled output drives the bus line to a high or low logic level. Each output has its own output-enable ( $\overline{OE}$ ) input. The output is disabled when  $\overline{OE}$  is high.

The SN54ALS253 is characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN74ALS253 and SN74AS253A are characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

SN54ALS253 . . . J PACKAGE  
SN74ALS253, SN74AS253A . . . D OR N PACKAGE  
(TOP VIEW)



SN54ALS253 . . . FK PACKAGE  
(TOP VIEW)



NC – No internal connection

FUNCTION TABLE

| INPUTS              |   |      |    |    |    |                        | OUTPUT<br>Y |
|---------------------|---|------|----|----|----|------------------------|-------------|
| SELECT <sup>†</sup> |   | DATA |    |    |    | $\overline{\text{OE}}$ |             |
| B                   | A | C0   | C1 | C2 | C3 |                        |             |
| X                   | X | X    | X  | X  | X  | H                      | Z           |
| L                   | L | L    | X  | X  | X  | L                      | L           |
| L                   | L | H    | X  | X  | X  | L                      | H           |
| L                   | H | X    | L  | X  | X  | L                      | L           |
| L                   | H | X    | H  | X  | X  | L                      | H           |
| H                   | L | X    | X  | L  | X  | L                      | L           |
| H                   | L | X    | X  | H  | X  | L                      | H           |
| H                   | H | X    | X  | X  | L  | L                      | L           |
| H                   | H | X    | X  | X  | H  | L                      | H           |

<sup>†</sup> Select inputs A and B are common to both sections.

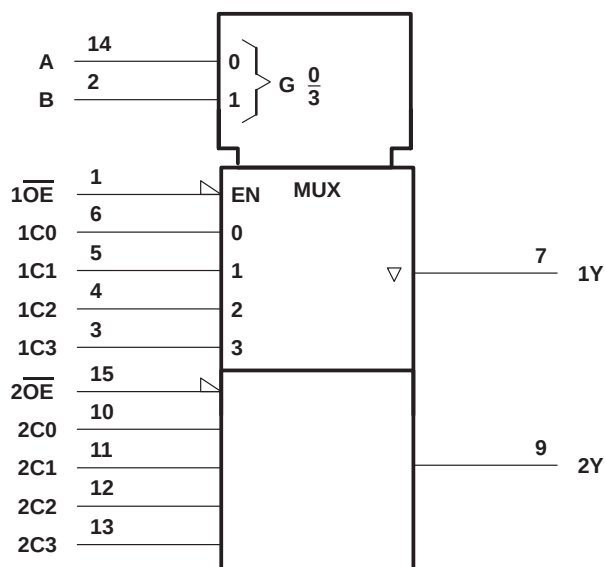
# SN54ALS253, SN74ALS253, SN74AS253A

## DUAL 1-OF-4 DATA SELECTORS/MULTIPLEXERS

### WITH 3-STATE OUTPUTS

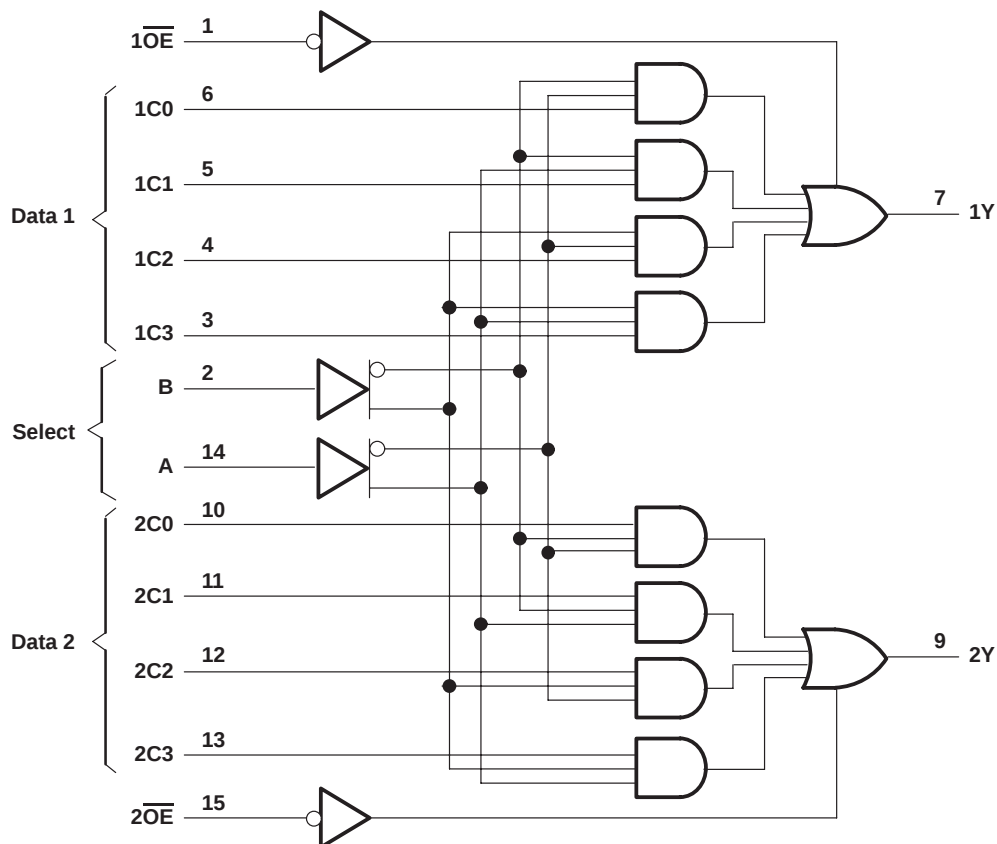
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#### logic symbol†



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.  
Pin numbers shown are for the D, J, and N packages.

#### logic diagram (positive logic)



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

# SN54ALS253, SN74ALS253, SN74AS253A DUAL 1-OF-4 DATA SELECTORS/MULTIPLEXERS WITH 3-STATE OUTPUTS

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## absolute maximum ratings over operating free-air temperature range (unless otherwise noted)<sup>†</sup>

|                                                          |                |
|----------------------------------------------------------|----------------|
| Supply voltage, $V_{CC}$                                 | 7 V            |
| Input voltage, $V_I$                                     | 7 V            |
| Voltage applied to a disabled 3-state output             | 5.5 V          |
| Operating free-air temperature range, $T_A$ : SN54ALS253 | –55°C to 125°C |
| SN74ALS253                                               | 0°C to 70°C    |
| Storage temperature range                                | –65°C to 150°C |

<sup>†</sup> Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

## recommended operating conditions

|          |                                | SN54ALS253 |     |     | SN74ALS253 |     |      | UNIT |
|----------|--------------------------------|------------|-----|-----|------------|-----|------|------|
|          |                                | MIN        | NOM | MAX | MIN        | NOM | MAX  |      |
| $V_{CC}$ | Supply voltage                 | 4.5        | 5   | 5.5 | 4.5        | 5   | 5.5  | V    |
| $V_{IH}$ | High-level input voltage       | 2          |     |     | 2          |     |      | V    |
| $V_{IL}$ | Low-level input voltage        |            |     | 0.7 |            |     | 0.8  | V    |
| $I_{OH}$ | High-level output current      |            |     | –1  |            |     | –2.6 | mA   |
| $I_{OL}$ | Low-level output current       |            |     | 12  |            |     | 24   | 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            |                    | SN54ALS253   |                  |      | SN74ALS253   |                  |      | UNIT |
|------------|----------------------------|--------------------|--------------|------------------|------|--------------|------------------|------|------|
|            |                            |                    | MIN          | TYP <sup>‡</sup> | MAX  | MIN          | TYP <sup>‡</sup> | MAX  |      |
| $V_{IK}$   | $V_{CC} = 4.5$ V,          | $I_I = -18$ mA     |              |                  | –1.5 |              |                  | –1.5 | V    |
| $V_{OH}$   | $V_{CC} = 4.5$ V to 5.5 V, | $I_{OH} = -0.4$ mA | $V_{CC} - 2$ |                  |      | $V_{CC} - 2$ |                  |      | V    |
|            | $V_{CC} = 4.5$ V           | $I_{OH} = -1$ mA   | 2.4          | 3.3              |      |              |                  |      |      |
|            |                            | $I_{OH} = -2.6$ mA |              |                  |      | 2.4          | 3.2              |      |      |
| $V_{OL}$   | $V_{CC} = 4.5$ V           | $I_{OL} = 12$ mA   |              | 0.25             | 0.4  |              | 0.25             | 0.4  | V    |
|            |                            | $I_{OL} = 24$ mA   |              |                  |      |              | 0.35             | 0.5  |      |
| $I_{OZH}$  | $V_{CC} = 5.5$ V,          | $V_O = 2.7$ V      |              |                  | 20   |              |                  | 20   | μA   |
| $I_{OZL}$  | $V_{CC} = 5.5$ V,          | $V_O = 0.4$ V      |              |                  | –20  |              |                  | –20  | μA   |
| $I_I$      | $V_{CC} = 5.5$ V,          | $V_I = 7$ V        |              |                  | 0.1  |              |                  | 0.1  | mA   |
| $I_{IH}$   | $V_{CC} = 5.5$ V,          | $V_I = 2.7$ V      |              |                  | 20   |              |                  | 20   | μA   |
| $I_{IL}$   | $V_{CC} = 5.5$ V,          | $V_I = 0.4$ V      |              |                  | –0.1 |              |                  | –0.1 | mA   |
| $I_{OS}^§$ | $V_{CC} = 5.5$ V,          | $V_O = 2.25$ V     | –20          |                  | –112 | –30          |                  | –112 | mA   |
| $I_{CC}$   | $V_{CC} = 5.5$ V           | Outputs high       |              | 6.5              | 12   |              | 6.5              | 12   | mA   |
|            |                            | Outputs disabled   |              | 7.5              | 14   |              | 7.5              | 14   |      |

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

<sup>§</sup> The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current,  $I_{OS}$ .

# SN54ALS253, SN74ALS253, SN74AS253A

## DUAL 1-OF-4 DATA SELECTORS/MULTIPLEXERS

### WITH 3-STATE OUTPUTS

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#### switching characteristics (see Figure 1)

| PARAMETER        | FROM<br>(INPUT)        | TO<br>(OUTPUT) | V <sub>CC</sub> = 4.5 V to 5.5 V,<br>C <sub>L</sub> = 50 pF,<br>R1 = 500 Ω,<br>R2 = 500 Ω,<br>T <sub>A</sub> = MIN to MAX <sup>†</sup> |     |            |     | UNIT |
|------------------|------------------------|----------------|----------------------------------------------------------------------------------------------------------------------------------------|-----|------------|-----|------|
|                  |                        |                | SN54ALS253                                                                                                                             |     | SN74ALS253 |     |      |
|                  |                        |                | MIN                                                                                                                                    | MAX | MIN        | MAX |      |
| t <sub>PLH</sub> | A or B                 | Any Y          | 5                                                                                                                                      | 30  | 5          | 21  | ns   |
| t <sub>PHL</sub> |                        |                | 5                                                                                                                                      | 27  | 5          | 21  |      |
| t <sub>PLH</sub> | Data<br>(any C)        | Any Y          | 2                                                                                                                                      | 15  | 2          | 10  | ns   |
| t <sub>PHL</sub> |                        |                | 3                                                                                                                                      | 18  | 3          | 14  |      |
| t <sub>PZH</sub> | $\overline{\text{OE}}$ | Any Y          | 3                                                                                                                                      | 20  | 3          | 14  | ns   |
| t <sub>PZL</sub> |                        |                | 2                                                                                                                                      | 19  | 4          | 16  |      |
| t <sub>PHZ</sub> | $\overline{\text{OE}}$ | Any Y          | 2                                                                                                                                      | 12  | 2          | 10  | ns   |
| t <sub>PLZ</sub> |                        |                | 2                                                                                                                                      | 18  | 2          | 14  |      |

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

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

|                                                                   |                |
|-------------------------------------------------------------------|----------------|
| Supply voltage, V <sub>CC</sub>                                   | 7 V            |
| Input voltage, V <sub>I</sub>                                     | 7 V            |
| Operating free-air temperature range, T <sub>A</sub> : SN74AS253A | 0°C to 70°C    |
| Storage temperature range                                         | –65°C to 150°C |

‡ Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

#### recommended operating conditions

|                 |                                | SN74AS253A |     |     | UNIT |
|-----------------|--------------------------------|------------|-----|-----|------|
|                 |                                | MIN        | NOM | MAX |      |
| V <sub>CC</sub> | Supply voltage                 | 4.5        | 5   | 5.5 | V    |
| V <sub>IH</sub> | High-level input voltage       | 2          |     |     | V    |
| V <sub>IL</sub> | Low-level input voltage        |            |     | 0.8 | V    |
| I <sub>OH</sub> | High-level output current      |            |     | –15 | mA   |
| I <sub>OL</sub> | Low-level output current       |            |     | 48  | mA   |
| T <sub>A</sub>  | Operating free-air temperature | 0          |     | 70  | °C   |



**SN54ALS253, SN74ALS253, SN74AS253A**  
**DUAL 1-OF-4 DATA SELECTORS/MULTIPLEXERS**  
**WITH 3-STATE OUTPUTS**

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

| PARAMETER      |            | TEST CONDITIONS                                                       | SN74AS253A   |                  |      | UNIT          |
|----------------|------------|-----------------------------------------------------------------------|--------------|------------------|------|---------------|
|                |            |                                                                       | MIN          | TYP <sup>†</sup> | MAX  |               |
| $V_{IK}$       |            | $V_{CC} = 4.5\text{ V}$ ,<br>$I_I = -18\text{ mA}$                    |              |                  | -1.2 | V             |
| $V_{OH}$       |            | $V_{CC} = 4.5\text{ V to } 5.5\text{ V}$ ,<br>$I_{OH} = -2\text{ mA}$ | $V_{CC} - 2$ |                  |      | V             |
|                |            | $V_{CC} = 4.5\text{ V}$ ,<br>$I_{OH} = -15\text{ mA}$                 | 2.4          | 3.2              |      |               |
| $V_{OL}$       |            | $V_{CC} = 4.5\text{ V}$ ,<br>$I_{OL} = 48\text{ mA}$                  | 0.35         | 0.5              |      | V             |
| $I_{OZH}$      |            | $V_{CC} = 5.5\text{ V}$ ,<br>$V_O = 2.7\text{ V}$                     |              |                  | 50   | $\mu\text{A}$ |
| $I_{OZL}$      |            | $V_{CC} = 5.5\text{ V}$ ,<br>$V_O = 0.4\text{ V}$                     |              |                  | -50  | $\mu\text{A}$ |
| $I_I$          | A, B       | $V_{CC} = 5.5\text{ V}$ ,<br>$V_I = 7\text{ V}$                       |              |                  | 0.2  | mA            |
|                | All others |                                                                       |              |                  | 0.1  |               |
| $I_{IH}$       | A, B       | $V_{CC} = 5.5\text{ V}$ ,<br>$V_I = 2.7\text{ V}$                     |              |                  | 40   | $\mu\text{A}$ |
|                | All others |                                                                       |              |                  | 20   |               |
| $I_{IL}$       | A, B       | $V_{CC} = 5.5\text{ V}$ ,<br>$V_I = 0.4\text{ V}$                     |              |                  | -1   | mA            |
|                | All others |                                                                       |              |                  | -0.5 |               |
| $I_O^\ddagger$ |            | $V_{CC} = 5.5\text{ V}$ ,<br>$V_O = 2.25\text{ V}$                    | -30          |                  | -112 | mA            |
| $I_{CC}$       |            | $V_{CC} = 5.5\text{ V}$                                               |              |                  | 18   | mA            |
|                |            |                                                                       |              |                  | 29   |               |
|                |            |                                                                       |              |                  | 20   |               |
|                |            | Outputs disabled                                                      |              |                  | 21   | 33            |

<sup>†</sup> All typical values are at  $V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

<sup>‡</sup> The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current,  $I_{OS}$ .

**switching characteristics (see Figure 1)**

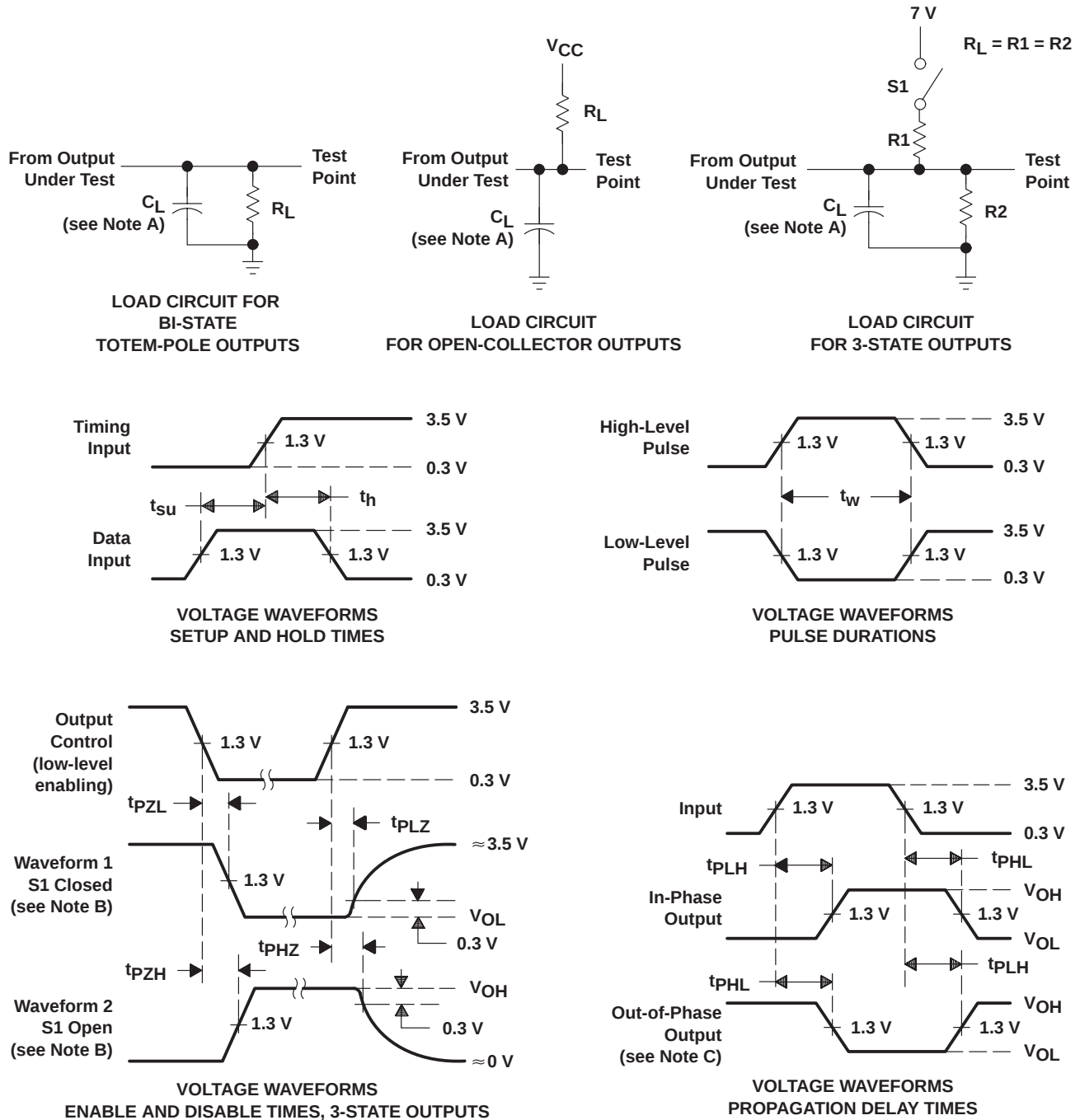
| PARAMETER | FROM<br>(INPUT) | TO<br>(OUTPUT) | VCC = 4.5 V to 5.5 V,<br>CL = 50 pF,<br>R1 = 500 Ω,<br>R2 = 500 Ω,<br>TA = MIN to MAX§ |      | UNIT |
|-----------|-----------------|----------------|----------------------------------------------------------------------------------------|------|------|
|           |                 |                | SN74AS253A                                                                             |      |      |
|           |                 |                | MIN                                                                                    | MAX  |      |
| tPLH      | A or B          | Y              | 3                                                                                      | 13.5 | ns   |
| tPHL      |                 |                | 3                                                                                      | 11.5 |      |
| tPLH      | Data<br>(any C) | Y              | 2.5                                                                                    | 7.5  | ns   |
| tPHL      |                 |                | 2.5                                                                                    | 8    |      |
| tPZH      | OE              | Any Y          | 2                                                                                      | 12.5 | ns   |
| tPZL      |                 |                | 2.5                                                                                    | 11.5 |      |
| tPHZ      | OE              | Any Y          | 1                                                                                      | 6    | ns   |
| tPLZ      |                 |                | 1                                                                                      | 7    |      |

<sup>§</sup> For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

# SN54ALS253, SN74ALS253, SN74AS253A DUAL 1-OF-4 DATA SELECTORS/MULTIPLEXERS WITH 3-STATE OUTPUTS

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## PARAMETER MEASUREMENT INFORMATION SERIES 54ALS/74ALS AND 54AS/74AS DEVICES



- NOTES: A.  $C_L$  includes probe and jig capacitance.  
 B. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.  
 C. When measuring propagation delay items of 3-state outputs, switch S1 is open.  
 D. All input pulses have the following characteristics:  $PRR \leq 1$  MHz,  $t_r = t_f = 2$  ns, duty cycle = 50%.  
 E. The outputs are measured one at a time with one transition per measurement.

Figure 1. Load Circuits and Voltage Waveforms

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