# SN54LS354, SN54LS355, SN54LS356
# SN74LS354, SN74LS355, SN74LS356
# 8-LINE TO 1-LINE DATA SELECTORS/MULTIPLEXERS/REGISTERS

D2544, JULY 1979—REVISED MARCH 1988

- **Transparent Latches on Data Select Inputs**
- **Complementary Outputs**
- **Easily Expandable**
- **High-Density 20-Pin Package**

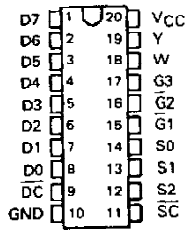
| | DATA REGISTERS | OUTPUTS |
|---|---|---|
| 'LS354 | Transparent | 3-State |
| 'LS355 | Transparent | Open-Collector |
| 'LS356 | Edge-Triggered | 3-State |

## description

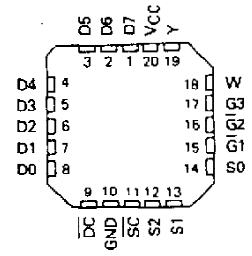
These monolithic data selectors/multiplexers contain full on-chip binary decoding to select one of eight data sources. The data-select address is stored in transparent latches that are enabled by a low level on pin 11, $\overline{SC}$. On the 'LS354 and 'LS355 a similar enable for data is obtained by a low level on pin 9, $\overline{DC}$. The edge-triggered data registers of the 'LS356 is clocked by a low-to-high transition on pin 9, CLK. Complementary outputs are available in either three-state versions ('LS354 and 'LS356) or open-collector version ('LS355).

The SN54LS354 through SN54LS356 are characterized for operation over the full military temperature range of −55°C to 125°C. The SN74LS354 through SN74LS356 are characterized for operation from 0°C to 70°C.

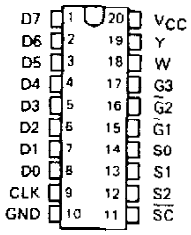
**SN54LS354, SN54LS355 . . . J PACKAGE**
**SN74LS354, SN74LS355 . . . DW OR N PACKAGE**
**(TOP VIEW)**



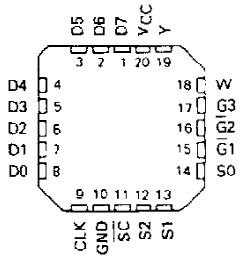

**SN54LS354, SN54LS355 . . . FK PACKAGE**
**(TOP VIEW)**




**SN54LS356 . . . J OR W PACKAGE**
**SN74LS356 . . . DW OR N PACKAGE**
**(TOP VIEW)**




**SN54LS356 . . . FK PACKAGE**
**(TOP VIEW)**

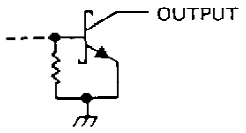


## FUNCTION TABLE

| INPUTS | | | | | | | | OUTPUTS | |
|---|---|---|---|---|---|---|---|---|---|
| SELECT | | | DATA CONTROL ('LS354, 'LS355) | CLOCK ('LS356) | OUTPUT ENABLES | | | | |
| S2 | S1 | S0 | | | $\overline{G1}$ | $\overline{G2}$ | G3 | W | Y |
| X | X | X | X | X | H | X | X | Z | Z |
| X | X | X | X | X | X | H | X | Z | Z |
| X | X | X | X | X | X | X | L | Z | Z |
| L | L | L | L | ↑ | L | L | H | $\overline{D0}$ | D0 |
| L | L | L | H | H or L | L | L | H | $\overline{D0}_n$ | $D0_n$ |
| L | L | H | L | ↑ | L | L | H | $\overline{D1}$ | D1 |
| L | L | H | H | H or L | L | L | H | $\overline{D1}_n$ | $D1_n$ |
| L | H | L | L | ↑ | L | L | H | $\overline{D2}$ | D2 |
| L | H | L | H | H or L | L | L | H | $\overline{D2}_n$ | $D2_n$ |
| L | H | H | L | ↑ | L | L | H | $\overline{D3}$ | D3 |
| L | H | H | H | H or L | L | L | H | $\overline{D3}_n$ | $D3_n$ |
| H | L | L | L | ↑ | L | L | H | D4 | D4 |
| H | L | L | H | H or L | L | L | H | $\overline{D4}_n$ | $D4_n$ |
| H | L | H | L | ↑ | L | L | H | $\overline{D5}$ | D5 |
| H | L | H | H | H or L | L | L | H | $\overline{D5}_n$ | $D5_n$ |
| H | H | L | L | ↑ | L | L | H | $\overline{D6}$ | D6 |
| H | H | L | H | H or L | L | L | H | $\overline{D6}_n$ | $D6_n$ |
| H | H | H | L | ↑ | L | L | H | $\overline{D7}$ | D7 |
| H | H | H | H | H or L | L | L | H | $\overline{D7}_n$ | $D7_n$ |

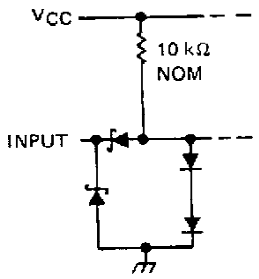
H = high level (steady state)
L = low level (steady state)
X = irrelevant (any input, including transitions)
Z = high-impedance state (off state)
↑ = transition from low to high level
D0 . . . D7 = the level of steady-state inputs at inputs D0 through D7, respectively, at the time of the low-to-high clock transition in the cae of 'LS356.
$D0_n$ . . . $D7_n$ = the level of steady state inputs at inputs D0 through D7, respectively, before the most recent low-to-high transition of data control or clock
This column shows the input address setup with $\overline{SC}$ low.

TYPICAL OF BOTH OUTPUTS ON 'LS355

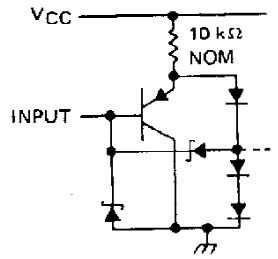



## schematics of inputs and outputs

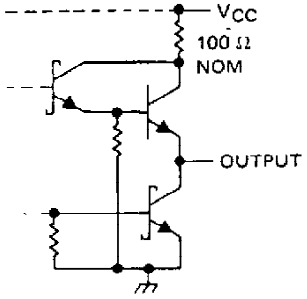
EQUIVALENT OF EACH DATA OR SELECT INPUT




EQUIVALENT OF ALL OTHER INPUTS




TYPICAL OF BOTH OUTPUTS ON 'LS354 AND 'LS356



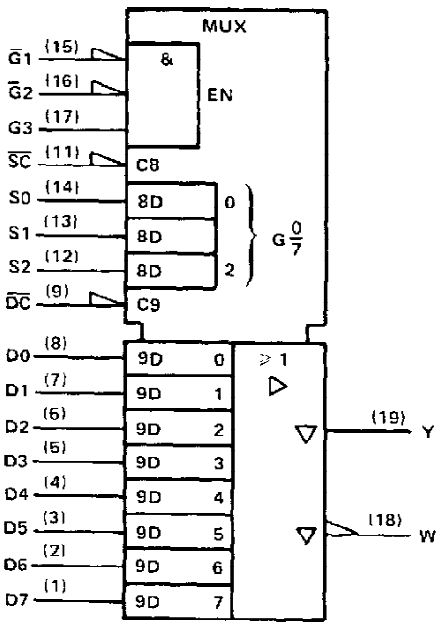

## absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

Supply voltage (see Note 1) . . . . . 7 V
Input voltage . . . . . 7 V
Operating free-air temperature range: SN54LS' . . . . . −55°C to 125°C
SN74LS' . . . . . 0°C to 70°C
Storage temperature range . . . . . −65°C to 150°C

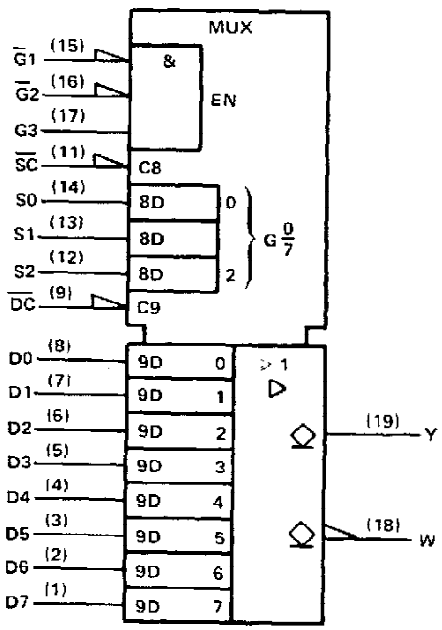
NOTE 1: Voltage values are with respect to network ground terminal.

## logic symbols†

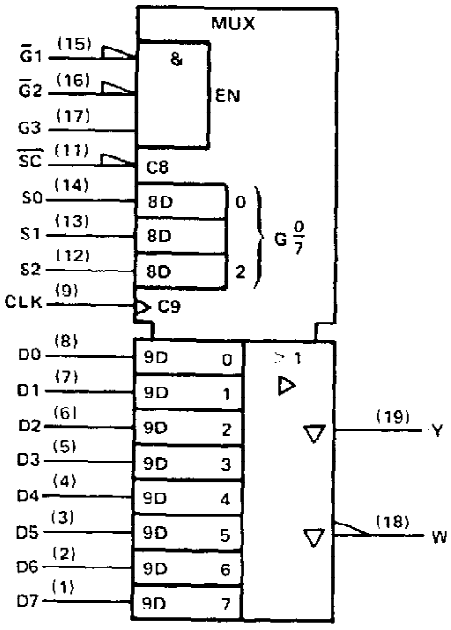
'LS354




'LS355



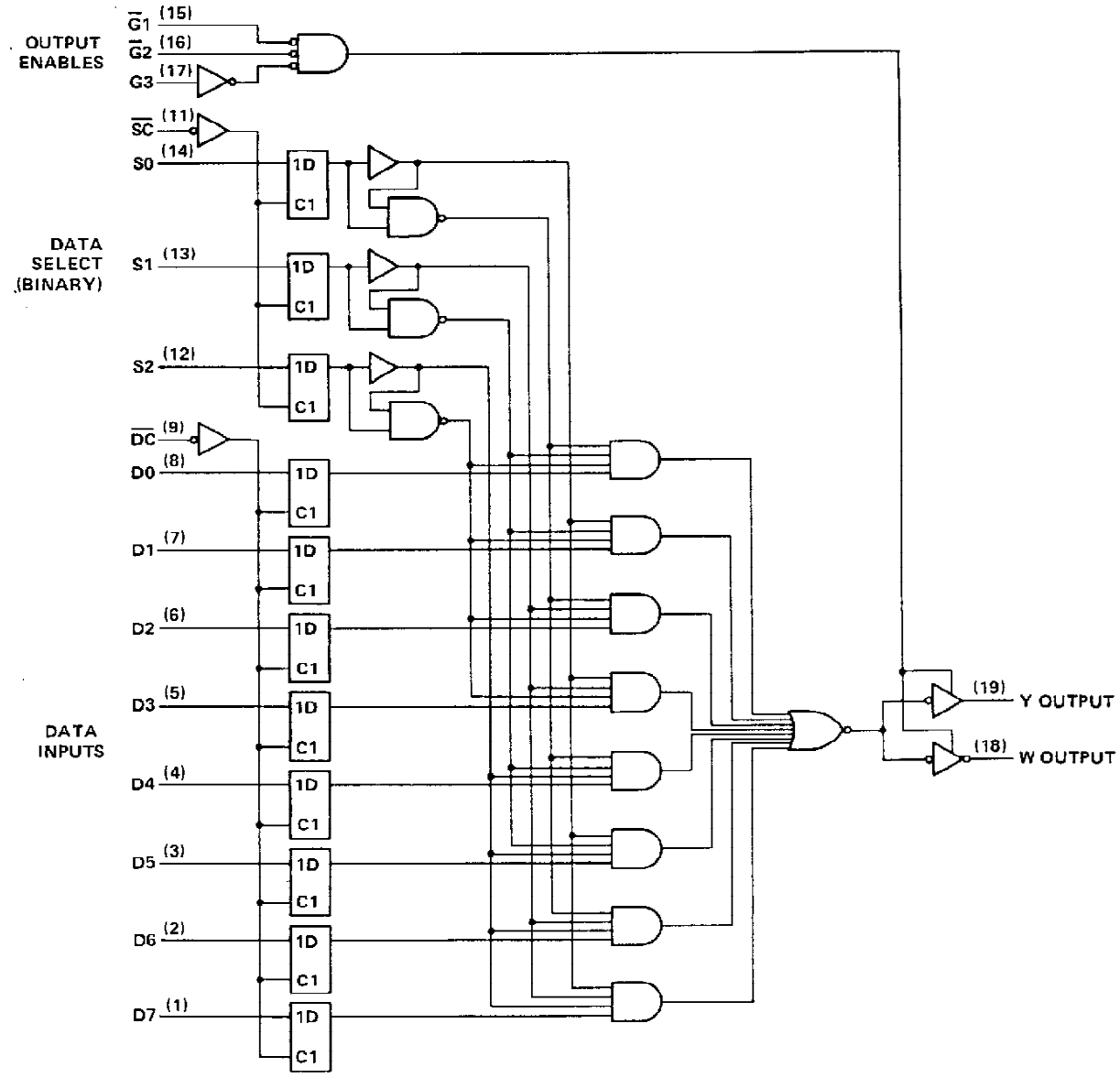

'LS356




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

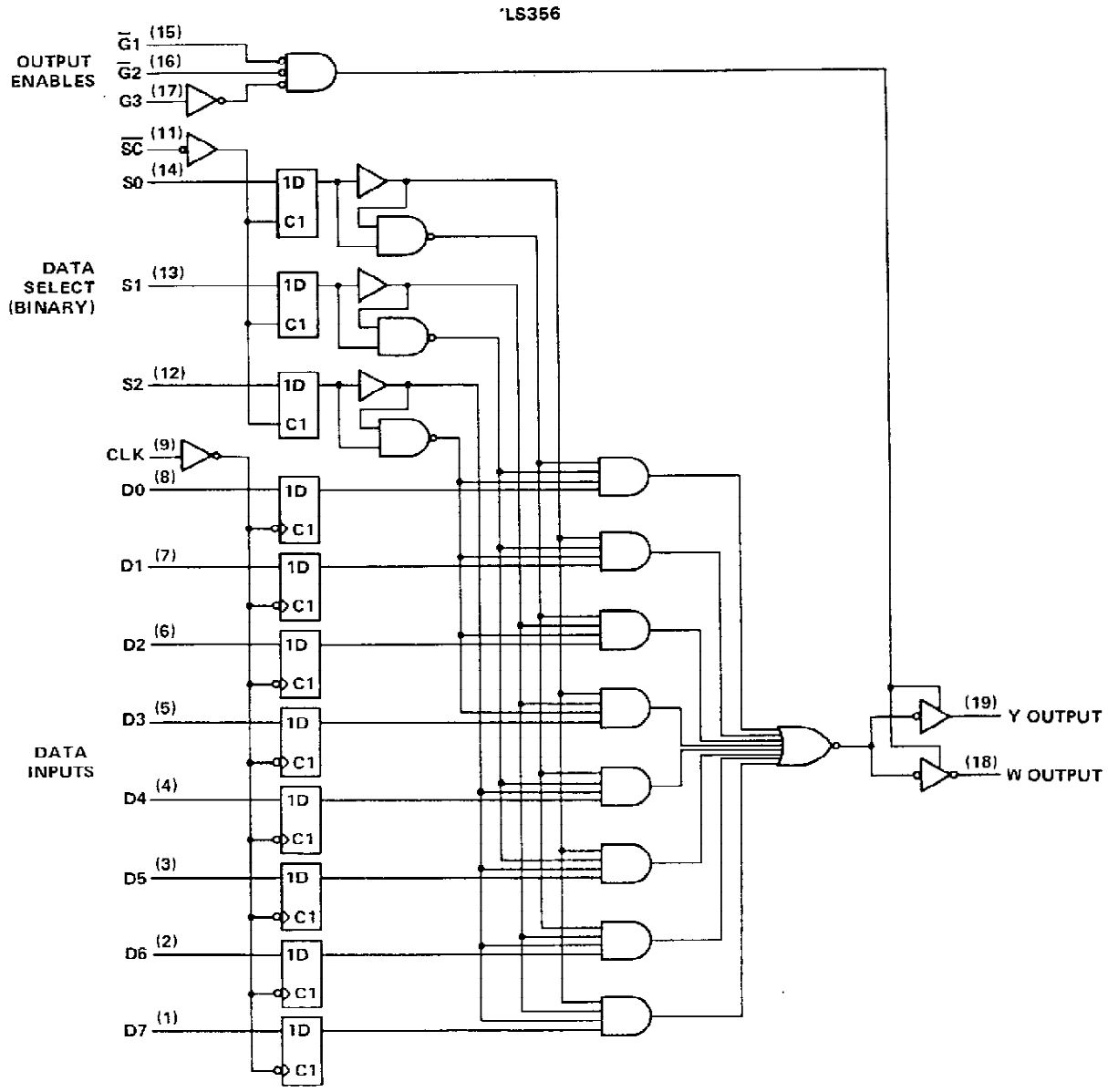
## logic diagram (positive logic)

'LS354, 'LS355




Pin numbers shown are for DW, J and N packages.

logic diagram (positive logic)




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

## recommended operating conditions

| | | | SN54LS354 SN54LS356 | | | SN74LS354 SN74LS356 | | | 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 | | | | 0.7 | | | 0.8 | V |
| $I_{OH}$ | High-level output current | | | | −1 | | | −2.6 | mA |
| $I_{OL}$ | Low-level output current | | | | 12 | | | 24 | mA |
| $t_{su}$ | Setup times, high-or-low-level data (with respect to ↑ at pin 9) | 'LS354 | 15 | | | 15 | | | ns |
| | | 'LS356 | 15 | | | 15 | | | |
| $t_h$ | Hold times, high-or-low-level data (with respect to ↑ at pin 9) | 'LS354 | 15 | | | 15 | | | ns |
| | | 'LS356 | 0 | | | 0 | | | |
| $T_A$ | Operating free-air temperature | | −55 | | 125 | 0 | | 70 | °C |

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

| PARAMETER | | TEST CONDITIONS† | | SN54LS354 SN54LS356 | | | SN74LS354 SN74LS356 | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP‡ | MAX | MIN | TYP‡ | MAX | |
| $V_{IK}$ | | $V_{CC}$ = MIN, $I_I$ = −18 mA | | | | −1.5 | | | −1.5 | V |
| $V_{OH}$ | | $V_{CC}$ = MIN, $V_{IH}$ = 2 V, $V_{IL}$ = MAX, $I_{OH}$ = MAX | | 2.4 | | | 2.4 | | | V |
| $V_{OL}$ | | $V_{CC}$ = MIN, $V_{IH}$ = 2 V, $V_{IL}$ = MAX | $I_{OL}$ = 12 mA | | 0.25 | 0.4 | | 0.25 | 0.4 | V |
| | | | $I_{OL}$ = 24 mA | | | | | 0.35 | 0.5 | |
| $I_{OZ}$ | | $V_{CC}$ = MAX | $V_O$ = 2.7 V | | | 20 | | | 20 | μA |
| | | | $V_O$ = 0.4 V | | | −20 | | | −20 | |
| $I_I$ | | $V_{CC}$ = MAX, $V_I$ = 7 V | | | | 0.1 | | | 0.1 | mA |
| $I_{IH}$ | | $V_{CC}$ = MAX, $V_I$ = 2.7 V | | | | 20 | | | 20 | μA |
| $I_{IL}$ | $\overline{DC}$ or CLK, $\overline{G}1$, $\overline{G}2$, G3 | $V_{CC}$ = MAX, $V_I$ = 0.4 V | | | | −0.2 | | | −0.2 | mA |
| | All others | | | | | −0.4 | | | −0.4 | |
| $I_{OS}$§ | | $V_{CC}$ = MAX | | −30 | | −130 | −30 | | −130 | mA |
| $I_{CC}$ | | $V_{CC}$ = MAX, See Note 2 | | | 29 | 46 | | 29 | 46 | mA |

† For conditions shown as MIN or MAX, use the appropriate values specified under recommended operating conditions.
‡ All typical values are at $V_{CC}$ = 5 V, $T_A$ = 25°C.
§ Not more than one output should be shorted at a time, and duration of the short-circuit should not exceed one second.
NOTE 2: $I_{CC}$ is measured with the inputs grounded and the outputs open.

## switching characteristics, $V_{CC}$ = 5 V, $T_A$ = 25°C, $R_L$ = 667 Ω

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | TEST CONDITIONS | 'LS354 | | | 'LS356 | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| $t_{PLH}$ | D0-D7 | Y | $C_L$ = 45 pF, See Note 3 | | 24 | 36 | | | | ns |
| $t_{PHL}$ | | | | | 23 | 35 | | | | |
| $t_{PLH}$ | | W | | | 18 | 27 | | | | ns |
| $t_{PHL}$ | | | | | 29 | 44 | | | | |
| $t_{PLH}$ | $\overline{DC}$ or CLK | Y | | | 28 | 42 | | 18 | 27 | ns |
| $t_{PHL}$ | | | | | 26 | 39 | | 33 | 50 | |
| $t_{PLH}$ | | W | | | 22 | 33 | | 24 | 36 | ns |
| $t_{PHL}$ | | | | | 33 | 50 | | 18 | 27 | |
| $t_{PLH}$ | S0, S1 S2 | Y | | | 29 | 44 | | 30 | 45 | ns |
| $t_{PHL}$ | | | | | 24 | 45 | | 28 | 48 | |
| $t_{PLH}$ | | W | | | 28 | 42 | | 36 | 54 | ns |
| $t_{PHL}$ | | | | | 34 | 51 | | 30 | 45 | |
| $t_{PLH}$ | $\overline{SC}$ | Y | | | 34 | 51 | | 36 | 54 | ns |
| $t_{PHL}$ | | | | | 31 | 47 | | 40 | 60 | |
| $t_{PLH}$ | | W | | | 27 | 41 | | 32 | 48 | ns |
| $t_{PHL}$ | | | | | 40 | 60 | | 36 | 54 | |
| $t_{PZH}$ | $\overline{G1}$, $\overline{G2}$ | Y | | | 14 | 27 | | 14 | 25 | ns |
| $t_{PZL}$ | | | | | 18 | 27 | | 17 | 25 | |
| $t_{PHZ}$ | | | $C_L$ = 5 pF, See Note 3 | | 15 | 25 | | 16 | 24 | ns |
| $t_{PLZ}$ | | | | | 15 | 25 | | 16 | 24 | |
| $t_{PZH}$ | | W | $C_L$ = 45 pF, See Note 3 | | 12 | 24 | | 14 | 23 | ns |
| $t_{PZL}$ | | | | | 16 | 24 | | 16 | 23 | |
| $t_{PHZ}$ | | | $C_L$ = 5 pF, See Note 3 | | 15 | 25 | | 16 | 23 | ns |
| $t_{PLZ}$ | | | | | 15 | 25 | | 16 | 23 | |
| $t_{PZH}$ | G3 | Y | $C_L$ = 45 pF, See Note 3 | | 15 | 29 | | 15 | 27 | ns |
| $t_{PZL}$ | | | | | 19 | 29 | | 18 | 27 | |
| $t_{PHZ}$ | | | $C_L$ = 5 pF, See Note 3 | | 15 | 25 | | 16 | 25 | ns |
| $t_{PLZ}$ | | | | | 15 | 25 | | 16 | 25 | |
| $t_{PZH}$ | | W | $C_L$ = 45 pF, See Note 3 | | 13 | 25 | | 14 | 25 | ns |
| $t_{PZL}$ | | | | | 17 | 25 | | 16 | 25 | |
| $t_{PHZ}$ | | | $C_L$ = 5 pF, See Note 3 | | 15 | 25 | | 16 | 25 | ns |
| $t_{PLZ}$ | | | | | 15 | 25 | | 16 | 25 | |

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

## recommended operating conditions

| | | SN54LS355 | | | SN74LS355 | | | 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 | | | 0.7 | | | 0.8 | V |
| $V_{OH}$ | High-level output voltage | | | 5.5 | | | 5.5 | V |
| $I_{OL}$ | Low-level output current | | | 12 | | | 24 | mA |
| $t_{su}$ | Setup times, high-or-low-level data, (with respect to ↑ at pin 9) | 15 | | | 15 | | | ns |
| $t_h$ | Hold times, high-or low-level data (with respect to ↑ at pin 9) | 15 | | | 15 | | | ns |
| $T_A$ | Operating free-air temperature | −55 | | 125 | 0 | | 70 | °C |

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

| PARAMETER | | TEST CONDITIONS† | | SN54LS355 | | | SN74LS355 | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP‡ | MAX | MIN | TYP‡ | MAX | |
| $V_{IK}$ | | $V_{CC}$ = MIN, $I_I$ = −18 mA | | | | −1.5 | | | −1.5 | V |
| $I_{OH}$ | | $V_{CC}$ = MIN, $V_{IH}$ = 2 V, $V_{IL}$ = MAX, $V_{OH}$ = 5.5 V | | | | 0.1 | | | 0.1 | mA |
| $V_{OL}$ | | $V_{CC}$ = MIN, $V_{IH}$ = 2 V, $V_{IL}$ = MAX | $I_{OL}$ = 12 mA | | 0.25 | 0.4 | | 0.25 | 0.4 | V |
| | | | $I_{OL}$ = 24 mA | | | | | 0.35 | 0.5 | |
| $I_I$ | | $V_{CC}$ = MAX, $V_I$ = 7 V | | | | 0.1 | | | 0.1 | mA |
| $I_{IH}$ | | $V_{CC}$ = MAX, $V_I$ = 2.7 V | | | | 20 | | | 20 | μA |
| $I_{IL}$ | $\overline{DC}$ or CLK, $\overline{G1}$, $\overline{G2}$, G3 | $V_{CC}$ = MAX, $V_I$ = 0.4 V | | | | −0.2 | | | −0.2 | mA |
| | All others | | | | | −0.4 | | | −0.4 | |
| $I_{CC}$ | | $V_{CC}$ = MAX, See Note 2 | | | 29 | 46 | | 29 | 46 | mA |

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable type.
‡ All typical values are at $V_{CC}$ = 5 V, $T_A$ = 25°C.
NOTE 2: $I_{CC}$ is measured with the inputs grounded and the outputs open.

## switching characteristics, $V_{CC}$ = 5 V, $T_A$ = 25°C, $R_L$ = 667 Ω

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | TEST CONDITIONS | 'LS355 MIN | 'LS355 TYP | 'LS355 MAX | UNIT |
|---|---|---|---|---|---|---|---|
| $t_{PLH}$ | D0-D7 | Y | $C_L$ = 45 pF, See Note 3 | | 34 | 41 | ns |
| $t_{PHL}$ | | | | | 26 | 39 | |
| $t_{PLH}$ | | W | | | 30 | 45 | ns |
| $t_{PHL}$ | | | | | 33 | 50 | |
| $t_{PLH}$ | $\overline{DC}$ or CLK | Y | | | 38 | 57 | ns |
| $t_{PHL}$ | | | | | 31 | 47 | |
| $t_{PLH}$ | | W | | | 33 | 50 | ns |
| $t_{PHL}$ | | | | | 39 | 59 | |
| $t_{PLH}$ | S0, S1, S2 | Y | | | 39 | 59 | ns |
| $t_{PHL}$ | | | | | 36 | 49 | |
| $t_{PLH}$ | | W | | | 32 | 48 | ns |
| $t_{PHL}$ | | | | | 39 | 58 | |
| $t_{PLH}$ | $\overline{SC}$ | Y | | | 45 | 68 | ns |
| $t_{PHL}$ | | | | | 42 | 63 | |
| $t_{PLH}$ | | W | | | 44 | 66 | ns |
| $t_{PHL}$ | | | | | 45 | 68 | |
| $t_{PHL}$ | $\overline{G}1$, $\overline{G}2$ | Y | | | 21 | 32 | ns |
| $t_{PHL}$ | | | | | 22 | 33 | |
| $t_{PLH}$ | | W | | | 18 | 27 | ns |
| $t_{PHL}$ | | | | | 19 | 29 | |
| $t_{PLH}$ | G3 | Y | | | 24 | 36 | ns |
| $t_{PHL}$ | | | | | 25 | 40 | |
| $t_{PLH}$ | | W | | | 19 | 31 | ns |
| $t_{PHL}$ | | | | | 19 | 29 | |

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

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