

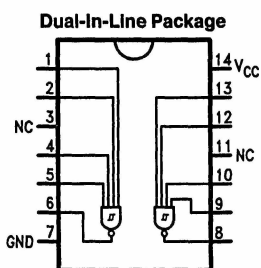
## 54LS13/DM74LS13

### Dual 4-Input Schmitt Trigger

#### General Description

This device contains two independent gates each of which perform the logic NAND function. Each input has hysteresis which increases the noise immunity and transforms a slowly changing input signal to a fast changing jitter free output.

#### Connection Diagram



TL/F/10166-1

**Order Number 54LS13DMQB, 54LS13FMQB,  
54LS13LMQB, DM74LS13M or DM74LS13N  
See NS Package Number E20A,  
J14A, M14A, N14A or W14B**

## Absolute Maximum Ratings (Note)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Supply Voltage 7V

Input Voltage 7V

Operating Free Air Temperature Range

54LS -55°C to +125°C

DM74LS 0°C to +70°C

Storage Temperature Range -65°C to +150°C

Note: The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the "Electrical Characteristics" table are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

## Recommended Operating Conditions

| Symbol          | Parameter                      | 54LS13 |     |      | DM74LS13 |     |      | Units |
|-----------------|--------------------------------|--------|-----|------|----------|-----|------|-------|
|                 |                                | 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        |        |     | 0.7  |          |     | 0.8  | V     |
| I <sub>OH</sub> | High Level Output Current      |        |     | -0.4 |          |     | -0.4 | mA    |
| I <sub>OL</sub> | Low Level Output Current       |        |     | 4    |          |     | 8    | mA    |
| T <sub>A</sub>  | Free Air Operating Temperature | -55    |     | 125  | 0        |     | 70   | °C    |

## Electrical Characteristics over recommended operating free air temperature range (unless otherwise noted)

| Symbol                            | Parameter                                 | Conditions                                                             | Min                        | Typ<br>(Note 1) | Max          | Units |
|-----------------------------------|-------------------------------------------|------------------------------------------------------------------------|----------------------------|-----------------|--------------|-------|
| V <sub>I</sub>                    | Input Clamp Voltage                       | V <sub>CC</sub> = Min, I <sub>I</sub> = -18 mA                         |                            |                 | -1.5         | V     |
| V <sub>OH</sub>                   | High Level Output Voltage                 | V <sub>CC</sub> = Min, I <sub>OH</sub> = Max,<br>V <sub>IL</sub> = Max | 54LS<br>2.5<br>DM74<br>2.7 |                 |              | V     |
| V <sub>OL</sub>                   | Low Level Output Voltage                  | V <sub>CC</sub> = Min, I <sub>OL</sub> = Max,<br>V <sub>IH</sub> = Min | 54LS<br>DM74               |                 | 0.4<br>0.5   | V     |
|                                   |                                           | I <sub>OL</sub> = 4 mA, V <sub>CC</sub> = Min                          | DM74                       |                 | 0.4          |       |
| I <sub>I</sub>                    | Input Current @ Max Input Voltage         | V <sub>CC</sub> = Max, V <sub>I</sub> = 10V                            |                            |                 | 0.1          | mA    |
| I <sub>IH</sub>                   | High Level Input Current                  | V <sub>CC</sub> = Max, V <sub>I</sub> = 2.7V                           |                            |                 | 20           | μA    |
| I <sub>IL</sub>                   | Low Level Input Current                   | V <sub>CC</sub> = Max, V <sub>I</sub> = 0.4V                           |                            |                 | -0.4         | mA    |
| I <sub>OS</sub>                   | Short Circuit Output Current              | V <sub>CC</sub> = Max<br>(Note 2)                                      | 54LS<br>DM74               | -20<br>-20      | -100<br>-100 | mA    |
| I <sub>CCH</sub>                  | Supply Current with Outputs High          | V <sub>CC</sub> = Max<br>V <sub>IN</sub> = GND                         |                            |                 | 6.0          | mA    |
| I <sub>CCL</sub>                  | Supply Current with Outputs Low           | V <sub>CC</sub> = Max<br>V <sub>IN</sub> = OPEN                        |                            |                 | 7.0          | mA    |
| V <sub>T+</sub>                   | Positive-Going Threshold Voltage          | V <sub>CC</sub> = +5.0V                                                | 1.5                        |                 | 2.0          | V     |
| V <sub>T-</sub>                   | Negative-Going Threshold Voltage          | V <sub>CC</sub> = +5.0V                                                | 0.6                        |                 | 1.1          | V     |
| V <sub>T+</sub> - V <sub>T-</sub> | Hysteresis Voltage                        | V <sub>CC</sub> = +5.0V                                                | 0.4                        |                 |              | V     |
| I <sub>T+</sub>                   | Input Current at Positive-Going Threshold | V <sub>CC</sub> = +5.0V, V <sub>IN</sub> = V <sub>T+</sub>             | -0.14*                     |                 |              | mA    |
| I <sub>T-</sub>                   | Input Current at Negative-Going Threshold | V <sub>CC</sub> = +5.0V, V <sub>IN</sub> = V <sub>T-</sub>             | -0.18*                     |                 |              | mA    |

\*Typical Value

Note 1: All typicals are at V<sub>CC</sub> = 5V, T<sub>A</sub> = 25°C.

Note 2: Not more than one output should be shorted at a time, and the duration should not exceed one second.

Switching Characteristics

V<sub>CC</sub> = +5.0V, T<sub>A</sub> = +25°C (See Section 1 for test waveforms and output load)

| Symbol           | Parameter                                          | R <sub>L</sub> = 2 kΩ, C <sub>L</sub> = 15 pF |     |      |     | Units |
|------------------|----------------------------------------------------|-----------------------------------------------|-----|------|-----|-------|
|                  |                                                    | 54LS                                          |     | DM74 |     |       |
|                  |                                                    | Min                                           | Max | Min  | Max |       |
| t <sub>PLH</sub> | Propagation Delay Time<br>Low to High Level Output |                                               | 22  |      | 25  | ns    |
| t <sub>PHL</sub> | Propagation Delay Time<br>High to Low Level Output |                                               | 27  |      | 30  | ns    |