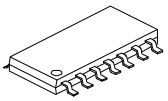
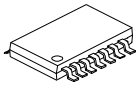
# QUAD 2-INPUT NAND SCHMITT TRIGGER



SOP-14



TSSOP-14

## ■ DESCRIPTION

The **UCD4093B** device is designed for 3V to 15V $V_{CC}$ operation, but is designed specifically for 0.5V to 20V $V_{CC}$ operation.

This device consists of four Schmitt trigger circuits. Each circuit functions as a two-input NAND gate with Schmitt trigger action on both inputs. The gate switches at different points for positive and negative going signals. The difference between the positive voltage ($V_{T+}$) and the negative voltage($V_{T-}$) is defined as hysteresis voltage($V_H$).

This device is fully specified for partial-power-down applications using $I_{OFF}$. The $I_{OFF}$ circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down.

## ■ FEATURES

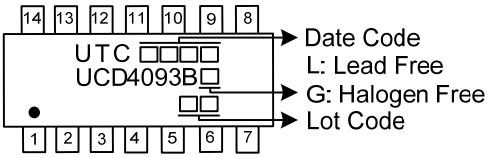
* Schmitt trigger action on each input with no external components
* Hysteresis voltage typically 0.9V at $V_{DD}$=5V and 2.3V at $V_{DD}$=10V
* Noise immunity greater than 50%
* No limit on input rise and fall times
* Standardized, symmetrical output characteristics
* 5V, 10V and 15V parametric ratings

## ■ ORDERING INFORMATION

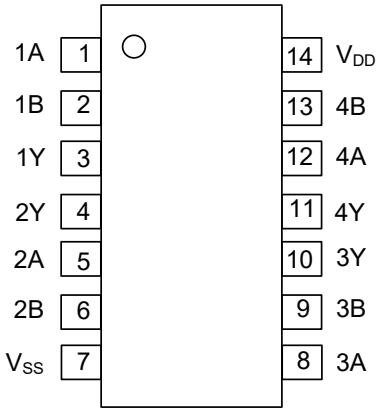
| Ordering Number | | Package | Packing |
|---|---|---|---|
| Lead Free | Halogen Free | | |
| UCD4093BL-S14-R | UCD4093BG-S14-R | SOP-14 | Tape Reel |
| UCD4093BL-P14-R | UCD4093BG-P14-R | TSSOP-14 | Tape Reel |

| | |
|---|---|
| UCD4093BG-S14-R<br>(1)Packing Type<br>(2)Package Type<br>(3)Green Package | (1) R: Tape Reel<br>(2) S14: SOP-14, P14: TSSOP-14<br>(3) G: Halogen Free and Lead Free, L: Lead Free |

## ■ MARKING




## ■ PIN CONFIGURATION

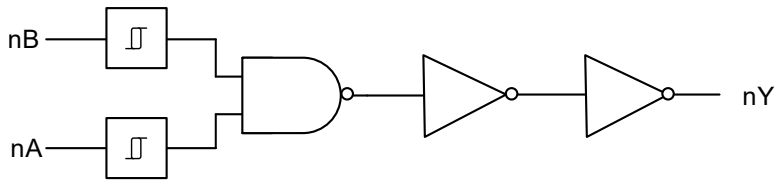



## ■ FUNCTION TABLE (each gate)

| INPUT | INPUT | OUTPUT |
|---|---|---|
| A | B | Y |
| L | L | H |
| L | H | H |
| H | L | H |
| H | H | L |

Note: H: HIGH Voltage Level L: LOW Voltage Level

## ■ LOGIC DIAGRAM (positive logic)



## ■ ABSOLUTE MAXIMUM RATING ($T_A$=25°C, unless otherwise specified) (Note 2)

| PARAMETER | SYMBOL | CONDITIONS | RATINGS | UNIT |
|---|---|---|---|---|
| Supply Voltage | $V_{DD}$ | | -0.5 ~ +20 | V |
| Input Voltage | $V_{IN}$ | | -0.5 ~ $V_{DD}$+0.5 | V |
| Input Clamp Current | $I_{IK}$ | $V_{IN}$<0V | ±10 | mA |
| Output Clamp Current | $I_{OK}$ | $V_{OUT}$<0V | ±10 | mA |
| Output Current | $I_{OUT}$ | | ±10 | mA |
| $V_{CC}$ or GND Current | $I_{CC}$ | | ±100 | mA |
| Supply Current | $I_{DD}$ | | 50 | mA |
| Storage Temperature | $T_{STG}$ | | -65 ~ +150 | °C |

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.

## ■ RECOMMENDED OPERATING CONDITIONS

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| Supply Voltage | $V_{DD}$ | Operating | 3 | | 15 | V |
| Input Voltage | $V_{IN}$ | | 0 | | $V_{DD}$ | V |
| Operating Temperature | $T_A$ | | -40 | | +125 | °C |

## ■ ELECTRICAL CHARACTERISTICS ($T_A$=25°C, unless otherwise specified)

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| High-Level Output Voltage | $V_{OH}$ | $V_{DD}$=5V, $\|I_{OH}\|$<1μA | 4.95 | | | V |
| | | $V_{DD}$=10V, $\|I_{OH}\|$<1μA | 9.95 | | | V |
| | | $V_{DD}$=15V, $\|I_{OH}\|$<1μA | 14.95 | | | V |
| Low-Level Output Voltage | $V_{OL}$ | $V_{DD}$=5V, $\|I_{OH}\|$<1μA | | | 0.5 | V |
| | | $V_{DD}$=10V, $\|I_{OH}\|$<1μA | | | 0.5 | V |
| | | $V_{DD}$=15V, $\|I_{OH}\|$<1μA | | | 0.5 | V |
| Positive-Going Threshold Voltage | $V_{T+}$ | $V_{DD}$=5V | 1.9 | 2.9 | 3.5 | V |
| | | $V_{DD}$=10V | 3.6 | 5.2 | 7 | V |
| | | $V_{DD}$=15V | 4.7 | 7.3 | 11 | V |
| Negative-Going Threshold Voltage | $V_{T-}$ | $V_{DD}$=5V | 1.5 | 2.2 | 3.1 | V |
| | | $V_{DD}$=10V | 3 | 4.2 | 6.4 | V |
| | | $V_{DD}$=15V | 4 | 6.0 | 10.3 | V |
| Hysteresis Voltage | $V_H$ | $V_{DD}$=5V | 0.4 | 0.7 | | V |
| | | $V_{DD}$=10V | 0.6 | 1.0 | | V |
| | | $V_{DD}$=15V | 0.4 | 1.3 | | V |
| High-Level Output Current | $I_{OH}$ | $V_{DD}$=5V, $V_{OUT}$=2.5V | | | -1.4 | mA |
| | | $V_{DD}$=5V, $V_{OUT}$=4.6V | | | -0.5 | mA |
| | | $V_{DD}$=10V, $V_{OUT}$=9.5V | | | -1.3 | mA |
| | | $V_{DD}$=15V, $V_{OUT}$=13.5V | | | -3.4 | mA |
| Low-Level Output Current | $I_{OL}$ | $V_{DD}$=5V, $V_{OUT}$=0.4V | 0.5 | | | mA |
| | | $V_{DD}$=10V, $V_{OUT}$=0.5V | 1.3 | | | mA |
| | | $V_{DD}$=15V, $V_{OUT}$=1.5V | 3.1 | | | mA |
| Input Leakage Current | $I_{I(LEAK)}$ | $V_{DD}$=15V | | | ±0.1 | μA |
| Quiescent Supply Current | $I_{DD}$ | $V_{DD}$=5V, $I_{OUT}$=0 | | | 0.25 | μA |
| | | $V_{DD}$=10V, $I_{OUT}$=0 | | | 0.5 | μA |
| | | $V_{DD}$=15V, $I_{OUT}$=0 | | | 1.0 | μA |

Note: $I_{OL}$ and $I_{OH}$ are tested one output at a time.

## ■ SWITCHING CHARACTERISTICS

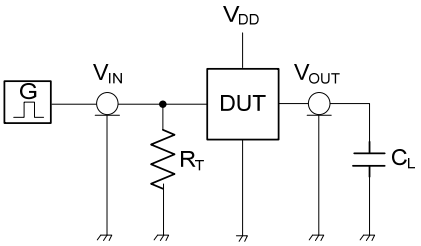
(Input: $t_R$=$t_F$=20ns, $C_L$=50pF, $R_L$=200KΩ, $T_A$=25°C, unless otherwise specified )

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| Propagation delay from Input(nA or nB) to Output(nY) | $t_{PHL}/t_{PLH}$ | $V_{DD}$=5V | | 190 | 380 | ns |
| | | $V_{DD}$=10V | | 90 | 180 | ns |
| | | $V_{DD}$=15V | | 65 | 130 | ns |
| Transition Time, Input (nY) to Output(nA or nB) | $t_{THL}/t_{TLH}$ | $V_{DD}$=5V | | 100 | 200 | ns |
| | | $V_{DD}$=10V | | 50 | 100 | ns |
| | | $V_{DD}$=15V | | 40 | 80 | ns |

## ■ OPERATING CHARACTERISTICS ($T_A$=25°C, unless otherwise specified)

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| Input Capacitance | $C_{IN}$ | Any Input | | 5 | 7.5 | pF |

## ■ TEST CIRCUIT AND WAVEFORMS




Note: $C_L$ includes probe and jig capacitance.

**Fig. 1 Test Circuit**

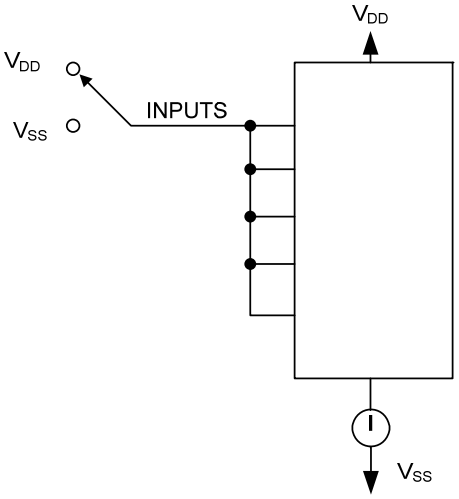



**Fig. 2 Quiescent Device Current Test Circuit**

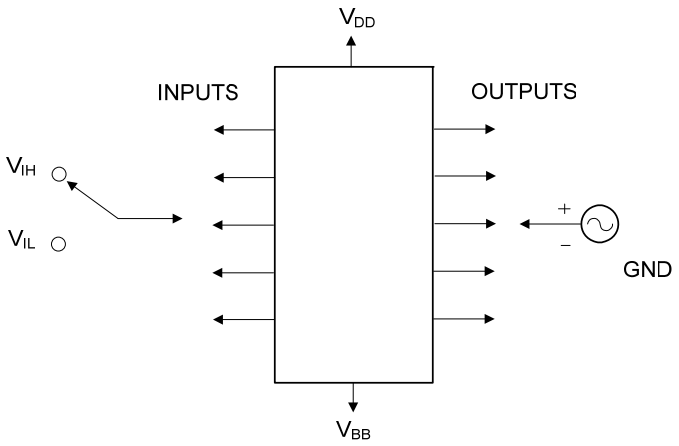



**Fig.3 Input Voltage Test Circuit**

| $V_{DD}$ | Inputs | | $V_M$ | $V_{LOAD}$ | $C_L$ | $R_L$ | $V_{\triangle}$ |
|---|---|---|---|---|---|---|---|
| | $V_{IN}$ | $t_R$ / $t_F$ | | | | | |
| 5V~15V | $V_{SS}$ Or $V_{DD}$ | | $0.5V_{DD}$ | | 50pF | | |

## ■ TEST CIRCUIT AND WAVEFORMS (Cont.)

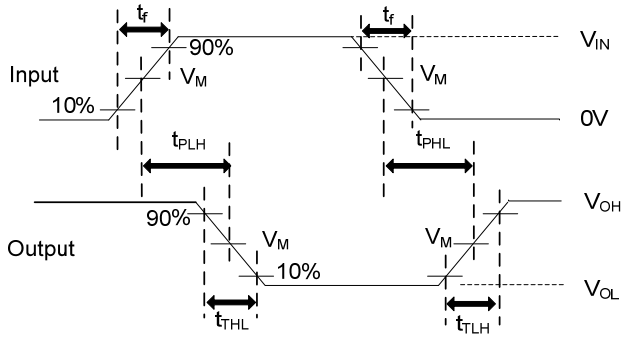



**Fig.4 Propagation Delay And Output Transition Time**

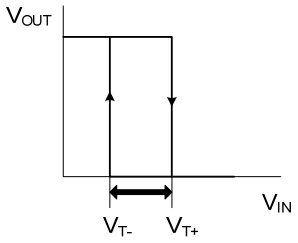



**Fig.5 Transfer Characteristic**

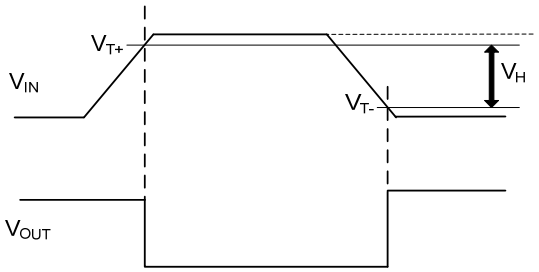



**Fig.6 Waveforms Showing Definition Of $V_{T+}$ And $V_{T-}$ (Between Limits At 30 % And 70 %) And $V_H$**

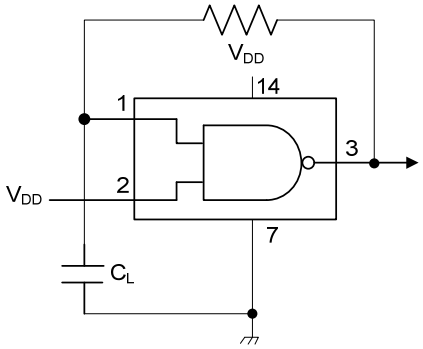



**Fig.7 Astable Multivibrator**

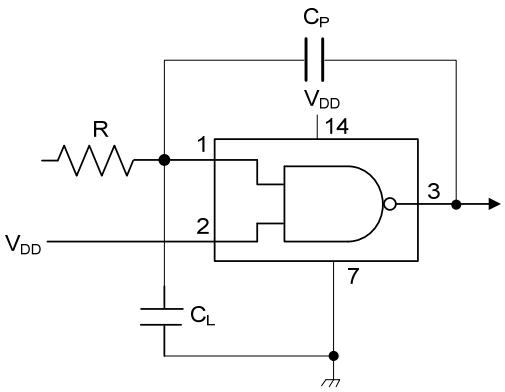



**Fig.8 Schmitt Trigger Driven Via A High-Impedance Input**

Notes: 1. $C_L$ includes probe and jig capacitance.
2. All input pulses are supplied by generators having the following characteristics: PRR ≤10MHz, $Z_O$ = 50Ω.