

## TSC321/322/323/324 NAND Gates

- Quad 2-Input (Active Pullup)
- Dual 5-Input (Active Pullup)
- Quad 2-Input (Open Collector)
- Quad 2-Input (Passive Pullup)

### Features

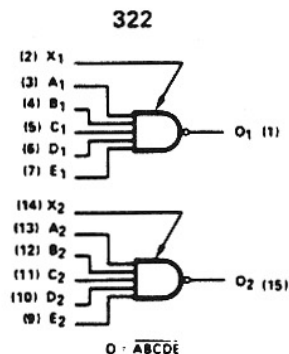
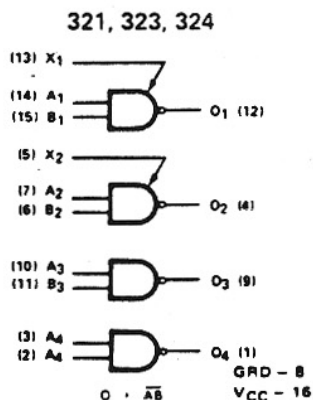
#### 321/322

- IDEAL FOR DRIVING LINES UP TO 10 FEET
- 5mA DRIVE CURRENT IN "1" STATE
- EXPANDER INPUTS
- ACTIVE PULLUP

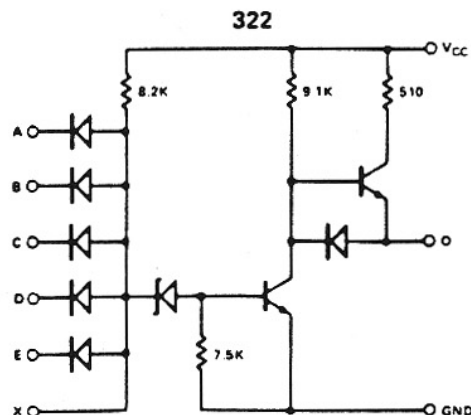
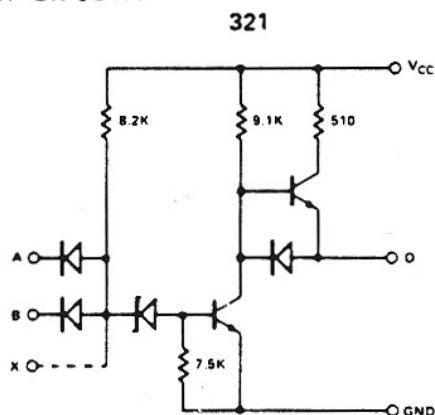
#### 323/324

- COLLECTOR OR'ABLE
- EXPANDER INPUTS
- 323 SINKS UP TO 11.5 mA (C TYPE) OR 14.0 mA (A TYPE)
- 323 OUTPUT LEVELS ADJUSTABLE TO DTL, TTL OR MOS LEVELS
- 324 HAS PULLUP RESISTORS ON CHIP
- 324 SINKS UP TO 16.8 mA (C TYPE) OR 20.8 mA (A TYPE)

### Logic Diagrams

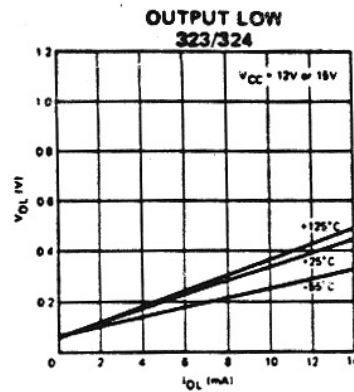
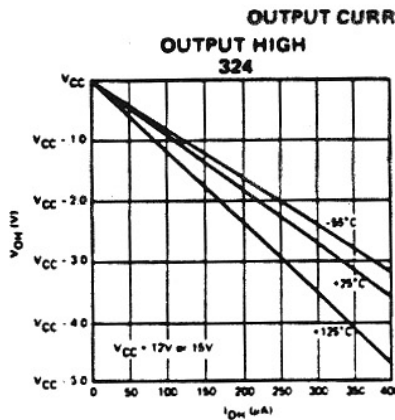
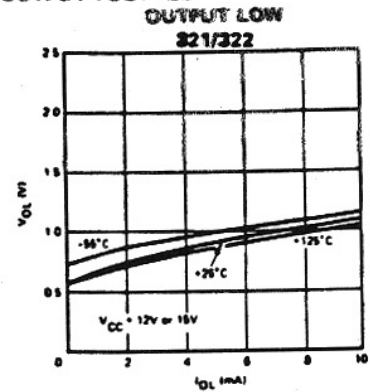
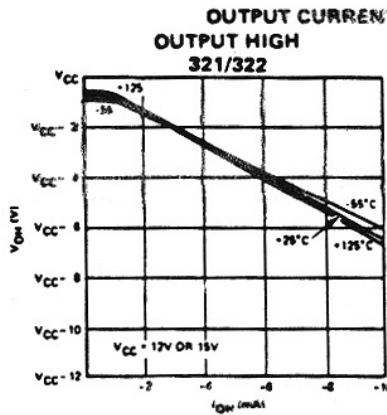
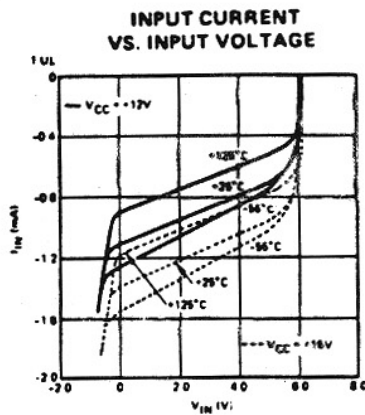


### Equivalent Circuits



# NAND Gates 321, 322, 323, 324

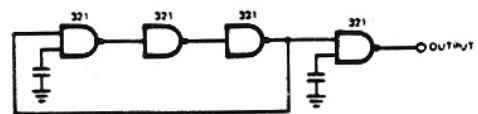
## Typical Performance Characteristics



## Typical Applications

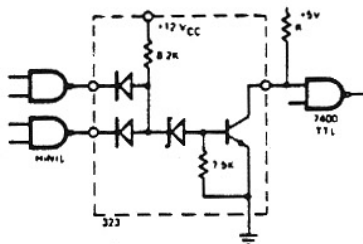
Rules for selecting external resistors and calculating fanout with collectors OR'd are given in the applications notes. The external resistor of the 323 may be connected to a voltage other than  $V_{CC}$  to adjust the output voltage level. The expandable gates may be provided any number of inputs by adding 331 gate expanders or 1N914 diodes (or any 20-volt silicon diodes) to the expander inputs.

### FREE-RUNNING MULTIVIBRATOR



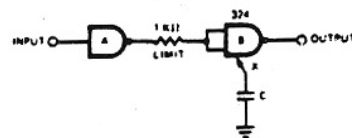
This self-starting circuit even works without capacitors.  
 $PW \approx 1.5 \mu\text{sec}$ .  $f \approx 3\text{MHz}$ .

### TTL INTERFACE



Choose the value of pullup resistor R by the rules given in the applications notes, with  $V_{CC} = 5V$ .

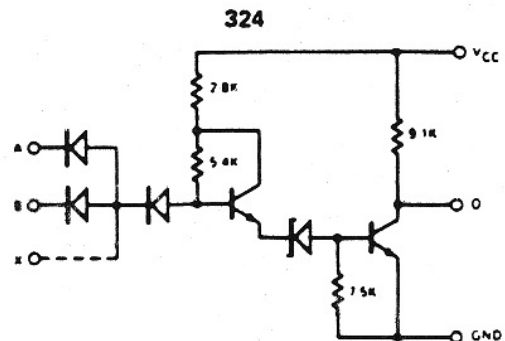
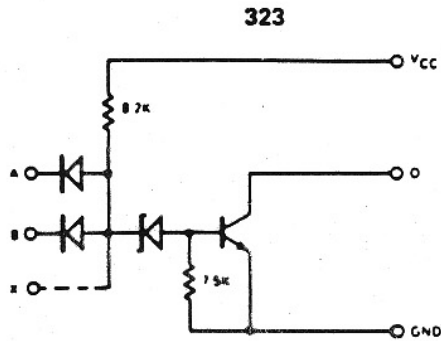
### SYSTEM MONITOR



This circuit is used in applications such as detecting presence of data on a normally quiet line, or detecting malfunctions represented by an absence of pulses on a normally active line. A steady succession of pulses at the input holds the output high, but the output goes low if the input remains low for longer than a minimum time established by the value of C. A high input allows C to discharge, switching gate B to a high output. However, a low input causes C to charge at a rate  $t = C(8.2K)$  where 8.2K is B's input resistor (internal). For B's output to switch to low, the input to gate A must go low long enough for C to charge above the threshold of gate B. Any new input pulse retriggers the circuit and switches the output to high.

## NAND Gates 321, 322, 323, 324

### Equivalent Circuits (contd.)



### Specifications

#### 321

|                           |                          |        |
|---------------------------|--------------------------|--------|
| $I_{CC}$ (WORST-CASE)     | 15 mA @ 13V, 20 mA @ 16V |        |
| $t_{PD}$                  | 200 ns                   | 300 ns |
| I/O FUNCTION FOR $t_{PD}$ | A+O-                     | A-O+   |

#### 322

|                           |                         |        |
|---------------------------|-------------------------|--------|
| $I_{CC}$ (WORST-CASE)     | 8 mA @ 13V, 11 mA @ 16V |        |
| $t_{PD}$                  | 190 ns                  | 550 ns |
| I/O FUNCTION FOR $t_{PD}$ | A+O-                    | A-O+   |

#### 323

|                           |                          |        |
|---------------------------|--------------------------|--------|
| $I_{CC}$ (WORST-CASE)     | 5.5 mA @ 13V, 8 mA @ 16V |        |
| $t_{PD}$                  | 160 ns                   | 400 ns |
| I/O FUNCTION FOR $t_{PD}$ | A+O-                     | A-O+   |

#### 324

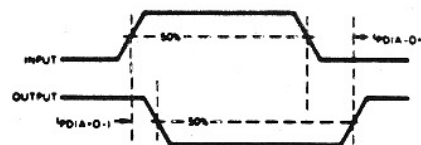
|                           |                          |        |
|---------------------------|--------------------------|--------|
| $I_{CC}$ (WORST-CASE)     | 28 mA @ 13V, 40 mA @ 16V |        |
| $t_{PD}$                  | 200 ns                   | 600 ns |
| I/O FUNCTION FOR $t_{PD}$ | A+O-                     | A-O+   |

#### NOTE:

$I_{CC}$  is tested at  $V_{CC} + 1$  Volt (+13V for C type and +16V for A type) and is guaranteed across the applicable temp range.  $t_{PD}$  is guaranteed at  $V_{CC} \pm 1V$  and across the applicable temp range with the output loaded with 5 unit loads.

See page 12 for electrical summary data.

### Switching Time Waveform



### Loading Table

| PINS      | FUNCTION        | LOADING                                                                            |
|-----------|-----------------|------------------------------------------------------------------------------------|
| A, B, A-E | Input Expanders | 1 UL                                                                               |
| X         |                 | Each diode tied to $X_1$ or $X_2$ is 1 unit load                                   |
| O         | Outputs         | 5 UL (321, 322, 324)<br>7 UL (324 with supplemental 10 k $\Omega$ pullup resistor) |

323 also handles 4 TTL loads at 400 mV.