# Signetics

# 54LS154
## Decoder/Demultiplexer

**Military Logic Products**

1-of-16 Decoder/Demultiplexer

*Product Specification*

## FEATURES
- **16-line demultiplexing capability**
- **Mutually exclusive outputs**
- **2-input enable gate for strobing or expansion**

## DESCRIPTION
The 54LS154 decoder accepts four active High binary address inputs and provides 16 mutually exclusive active Low outputs. The 2-input enable gate can be used to strobe the decoder to eliminate the normal decoding "glitches" on the outputs, or it can be used for expansion of the decoder. The enable gate has two AND'ed inputs which must be Low to enable the outputs.

The 54LS154 can be used as a 1-of-16 demultiplexer by using one of the enable inputs as the multiplexed data input. When the other enable is Low, the addressed output will follow the state of the applied data.

## ORDERING INFORMATION

| DESCRIPTION | ORDER CODE |
|---|---|
| 24-Pin Ceramic DIP | 54LS154/BJA |

## INPUT AND OUTPUT LOADING AND FAN-OUT TABLE

| PINS | DESCRIPTION | 54LS |
|---|---|---|
| All | Inputs | 1LSUL |
| All | Outputs | 10LSUL |

NOTE: Where a 54LS Unit Load (LSUL) is 20µA $I_{IH}$ and -0.4mA $I_{IL}$.

## ABSOLUTE MAXIMUM RATINGS (Over operating free-air temperature range unless otherwise noted.)

| SYMBOL | PARAMETER | RATING | UNIT |
|---|---|---|---|
| $V_{CC}$ | Supply voltage | 7.0 | V |
| $V_I$ | Input voltage range | -0.5 to +7.0 | V |
| $I_I$ | Input current range | -30 to +1 | mA |
| $V_O$ | Voltage applied to output in High output state range | -0.5 to $V_{CC}$ | V |
| $T_{STG}$ | Storage temperature range | -65 to +150 | °C |

## PIN CONFIGURATION



## LOGIC SYMBOL



$V_{CC}$ = Pin 24
GND = Pin 12
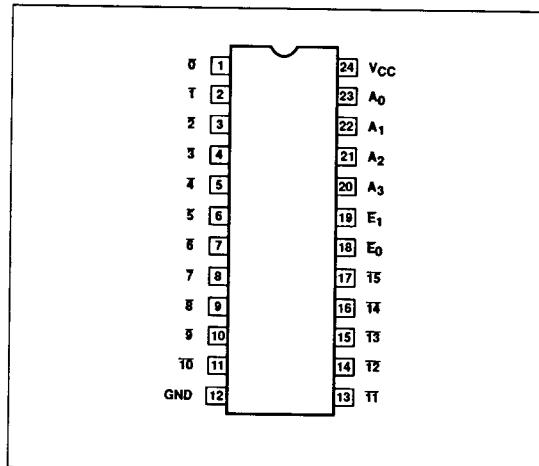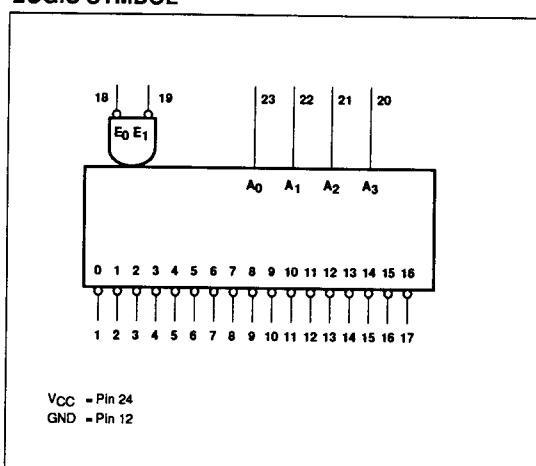
# Decoder/Demultiplexer

# 54LS154

## LOGIC DIAGRAM



$V_{CC}$ = Pin 24
GND = Pin 12
( ) = Pin numbers
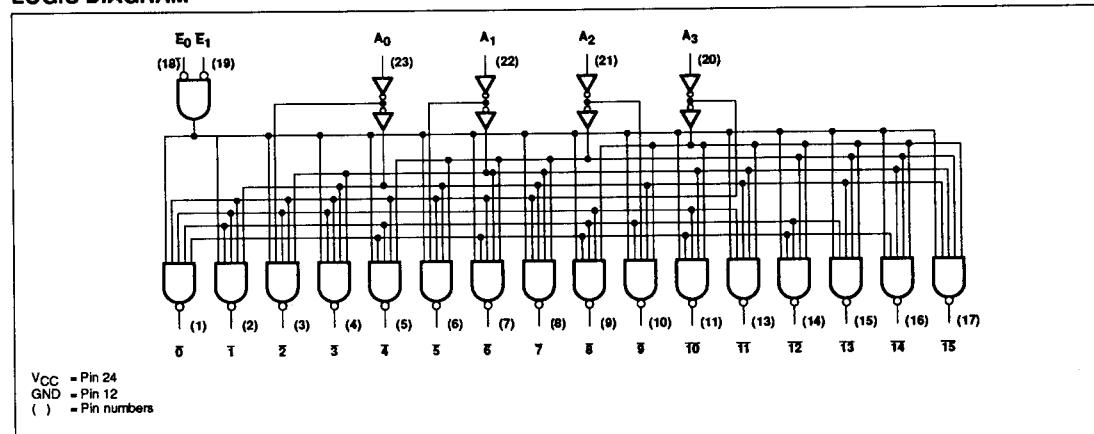
## FUNCTION TABLE

| INPUTS | | | | | | OUTPUT | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $E_0$ | $E_1$ | $A_3$ | $A_2$ | $A_1$ | $A_0$ | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| L | H | X | X | X | X | H | H | H | H | H | H | H | H | H | H | H | H | H | H | H | H |
| H | L | X | X | X | X | H | H | H | H | H | H | H | H | H | H | H | H | H | H | H | H |
| H | H | X | X | X | X | H | H | H | H | H | H | H | H | H | H | H | H | H | H | H | H |
| L | L | L | L | L | L | L | H | H | H | H | H | H | H | H | H | H | H | H | H | H | H |
| L | L | L | L | L | H | H | L | H | H | H | H | H | H | H | H | H | H | H | H | H | H |
| L | L | L | L | H | L | H | H | L | H | H | H | H | H | H | H | H | H | H | H | H | H |
| L | L | L | L | H | H | H | H | H | L | H | H | H | H | H | H | H | H | H | H | H | H |
| L | L | L | H | L | L | H | H | H | H | L | H | H | H | H | H | H | H | H | H | H | H |
| L | L | L | H | L | H | H | H | H | H | H | L | H | H | H | H | H | H | H | H | H | H |
| L | L | L | H | H | L | H | H | H | H | H | H | L | H | H | H | H | H | H | H | H | H |
| L | L | L | H | H | H | H | H | H | H | H | H | H | L | H | H | H | H | H | H | H | H |
| L | L | H | L | L | L | H | H | H | H | H | H | H | H | L | H | H | H | H | H | H | H |
| L | L | H | L | L | H | H | H | H | H | H | H | H | H | H | L | H | H | H | H | H | H |
| L | L | H | L | H | L | H | H | H | H | H | H | H | H | H | H | L | H | H | H | H | H |
| L | L | H | L | H | H | H | H | H | H | H | H | H | H | H | H | H | L | H | H | H | H |
| L | L | H | H | L | L | H | H | H | H | H | H | H | H | H | H | H | H | L | H | H | H |
| L | L | H | H | L | H | H | H | H | H | H | H | H | H | H | H | H | H | H | L | H | H |
| L | L | H | H | H | L | H | H | H | H | H | H | H | H | H | H | H | H | H | H | L | H |
| L | L | H | H | H | H | H | H | H | H | H | H | H | H | H | H | H | H | H | H | H | L |

H = High voltage level
L = Low voltage level
X = Don't care

## RECOMMENDED OPERATING CONDITIONS

| SYMBOL | PARAMETER | LIMITS | | | UNIT |
|---|---|---|---|---|---|
| | | Min | Nom | Max | |
| $V_{CC}$ | Supply voltage | 4.5 | 5.0 | 5.5 | V |
| $V_{IH}$ | High-level input voltage | 2.0 | | | V |
| $V_{IL}$ | Low-level input voltage | | | +0.7 | V |
| $I_{IK}$ | Input clamp current | | | -18 | mA |
| $I_{OH}$ | High-level output current | | | -400 | μA |
| $I_{OL}$ | Low-level output current | | | 4 | mA |
| $T_A$ | Operating free-air temperature range | -55 | | +125 | °C |

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## DC ELECTRICAL CHARACTERISTICS (Over recommended operating free-air temperature range unless otherwise noted.)

| SYMBOL | PARAMETER | TEST CONDITIONS[1] | LIMITS | | | UNIT |
|---|---|---|---|---|---|---|
| | | | Min | Typ[2] | Max | |
| $V_{OH}$ | High-level output voltage | $V_{CC}$ = Min, $V_{IH}$ = Min, $V_{IL}$ = Max, $I_{OH}$ = Max | 2.5 | 3.4 | | V |
| $V_{OL}$ | Low-level output voltage | $V_{CC}$ = Min, $V_{IH}$ = Min, $V_{IL}$ = Max, $I_{OL}$ = Max | | 0.25 | 0.4 | V |
| $V_{IK}$ | Input clamp voltage | $V_{CC}$ = Min, $I_I$ = $I_{IK}$ | | | -1.5 | V |
| $I_{IH2}$ | Input current at maximum input voltage | $V_{CC}$ = Max, $V_I$ = 7.0V | | | 0.1 | mA |
| $I_{IH1}$ | High-level input current | $V_{CC}$ = Max, $V_I$ = 2.7V | | | 20 | μA |
| $I_{IL}$ | Low-level input current | $V_{CC}$ = Max, $V_I$ = 0.4V | | | -0.4 | mA |
| $I_{OS}$ | Short-circuit output current[3] | $V_{CC}$ = Max | -15 | | -100 | mA |
| $I_{CC}$ | Supply current[4] (total) | $V_{CC}$ = Max | | 9 | 14 | mA |

## AC ELECTRICAL CHARACTERISTICS $T_A$ = 25°C, $V_{CC}$ = 5.0V[5]

| SYMBOL | PARAMETER | TEST CONDITIONS | LIMITS | | UNIT |
|---|---|---|---|---|---|
| | | | $C_L$ = 15pF | | |
| | | | Min | Max | |
| $t_{PLH}$ $t_{PHL}$ | Propagation delay Address to output | Waveform 1 | | 36 33 | ns ns |
| $t_{PLH}$ $t_{PHL}$ | Propagation delay Enable to output | Waveform 2 | | 30 27 | ns ns |

## AC ELECTRICAL CHARACTERISTICS $T_A$ = 25°C, $V_{CC}$ = 5.0V

| SYMBOL | PARAMETER | TEST CONDITIONS | LIMITS | | UNIT |
|---|---|---|---|---|---|
| | | | $C_L$ = 50pF | | |
| | | | Min | Max | |
| $t_{PLH}$ $t_{PHL}$ | Propagation delay Address to output | Waveform 1 | | 41 38 | ns ns |
| $t_{PLH}$ $t_{PHL}$ | Propagation delay Enable to output | Waveform 2 | | 35 32 | ns ns |

## AC ELECTRICAL CHARACTERISTICS $T_A$ = -55°C and + 125°C, $V_{CC}$ = 5.0V[5]

| SYMBOL | PARAMETER | TEST CONDITIONS | LIMITS | | UNIT |
|---|---|---|---|---|---|
| | | | $C_L$ = 50pF | | |
| | | | Min | Max | |
| $t_{PLH}$ $t_{PHL}$ | Propagation delay Address to output | Waveform 1 | | 53 49 | ns ns |
| $t_{PLH}$ $t_{PHL}$ | Propagation delay Enable to output | Waveform 2 | | 46 42 | ns ns |

**NOTES:**
1. For conditions shown as Min or Max, use the appropriate value specified under recommended operating conditions for the applicable type and function table operating mode.
2. All typical values are at $V_{CC}$ = 5V, $T_A$ = 25°C.
3. Not more than one output should be shorted at a time and duration of the short circuit should not exceed one second.
4. Measure $I_{CC}$ with all inputs grounded and all outputs open.
5. These parameters are guaranteed, but not tested.

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## AC WAVEFORMS
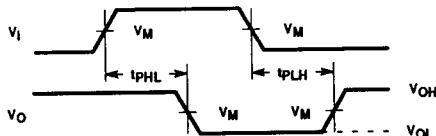


**Waveform 1. Waveform for Inverting Outputs**
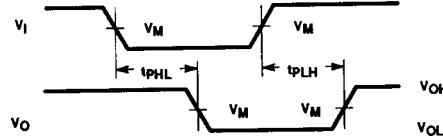
**Waveform 2. Waveform for Non-Inverting Outputs**

NOTE: $V_M = 1.3V$

## TEST CIRCUIT AND WAVEFORM
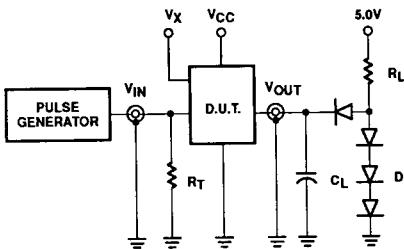


**Test Circuit for 54 Totem-Pole Outputs**
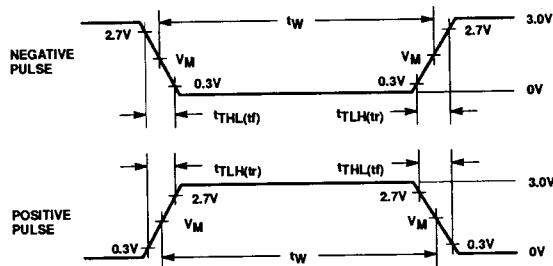
**Input Pulse Definition**

| FAMILY | INPUT PULSE CHARACTERISTICS | | | | | |
|---|---|---|---|---|---|---|
| | $R_L$ | $V_M$ | Rep. Rate | $T_W$ | $T_{TLH}$ | $T_{THL}$ |
| 54LSXXX | 2.0kΩ | 1.3V | 1MHz | 500ns | ≤15ns | ≤6ns |

**DEFINITIONS:**
$C_L$ = Load capacitance includes jig and probe capacitance; see AC Characteristics for value.
$R_T$ = Termination resistance should be equal to $Z_{OUT}$ of Pulse Generators.
D = Diodes are 1N916, 1N3064, or equivalent.
$V_X$ = Unclocked pins must be held at ≤0.8V, ≥2.7V or open per FunctionTable.