

Quad 2-input data selector/multiplexer (54F157A non-inverted, 54F158A inverted)

54F157A, 54F158A

DESCRIPTION

The 54F157A is a high-speed quad 2-input multiplexer which selects 4 bits of data from two sources under the control of a common Select input (S). The Enable input (E) is active Low. When E is High all of the outputs (Y) are forced Low regardless of all other input conditions.

Moving data from two groups of registers to four common output busses is a common use of the 54F157A. The state of the Select input determines the particular register from which the data comes. It can also be used as a function generator. The device is useful for implementing highly irregular logic by generating any four of the 16 different functions of two variables with one variable common.

The device is the logic implementation of a 4-pole, 2-position switch where the position of the switch is determined by the logic levels supplied to the Select input. Logic equations for the outputs are shown below:

$$\begin{aligned} Y_a &= E \cdot (I_{1a} \cdot S + I_{0a} \cdot \bar{S}) \\ Y_b &= E \cdot (I_{1b} \cdot S + I_{0b} \cdot \bar{S}) \\ Y_c &= E \cdot (I_{1c} \cdot S + I_{0c} \cdot \bar{S}) \\ Y_d &= E \cdot (I_{1d} \cdot S + I_{0d} \cdot \bar{S}) \end{aligned}$$

The 54F158A is similar but has inverting outputs:

$$\begin{aligned} \bar{Y}_a &= E \cdot (I_{1a} \cdot S + I_{0a} \cdot \bar{S}) \\ \bar{Y}_b &= E \cdot (I_{1b} \cdot S + I_{0b} \cdot \bar{S}) \\ \bar{Y}_c &= E \cdot (I_{1c} \cdot S + I_{0c} \cdot \bar{S}) \\ \bar{Y}_d &= E \cdot (I_{1d} \cdot S + I_{0d} \cdot \bar{S}) \end{aligned}$$

ORDERING INFORMATION

| DESCRIPTION | ORDER CODE | PACKAGE DESIGNATOR* |
|-------------------------|-----------------------------|---------------------|
| 16-Pin Ceramic DIP | 54F157A/BEA, 54F158A/BEA | GDIP1-T16 |
| 16-Pin Ceramic FlatPack | 54F157A/BFA, 54F158A/BFA | GDFF2-F16 |
| 20-Pin Ceramic LLCC | 54F157A/B2A, 54F158A/B2A | CQCC-N20 |

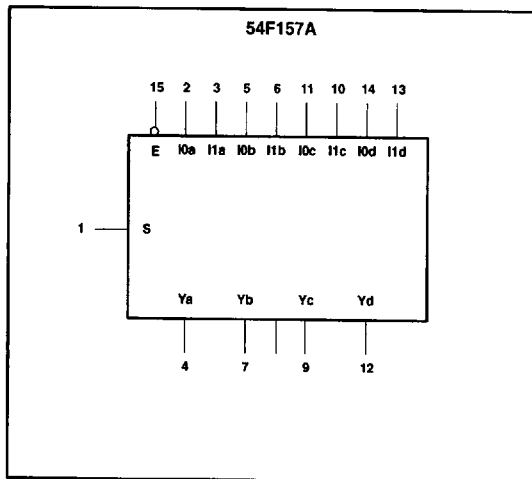
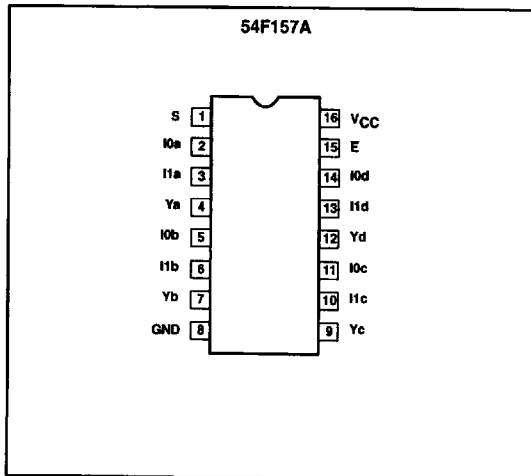
* MIL-STD 1835 or Appendix A of 1995 Military Data Handbook

INPUT AND OUTPUT LOADING AND FAN-OUT TABLE

| PINS | DESCRIPTION | 54F(U.L.) HIGH/LOW | LOAD VALUE HIGH/LOW |
|---|-------------|--------------------|---------------------|
| All | Inputs | 1.0/1.0 | 20µA/0.6mA |
| Y _a - Y _d , \bar{Y}_a - \bar{Y}_d | Outputs | 50/33 | 1.0mA/20mA |

NOTE: One (1.0) FAST Unit Load (U.L.) is defined as: 20µA in the High state and 0.6mA in the Low state.

PIN CONFIGURATION

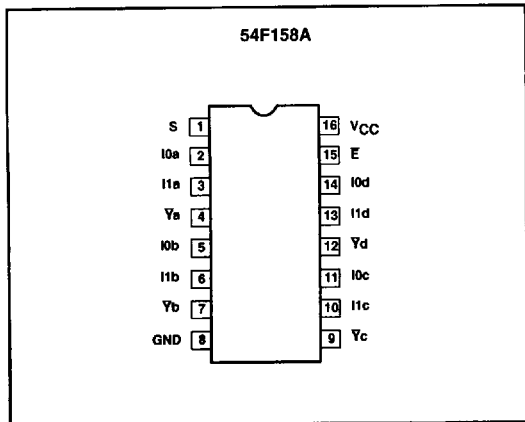


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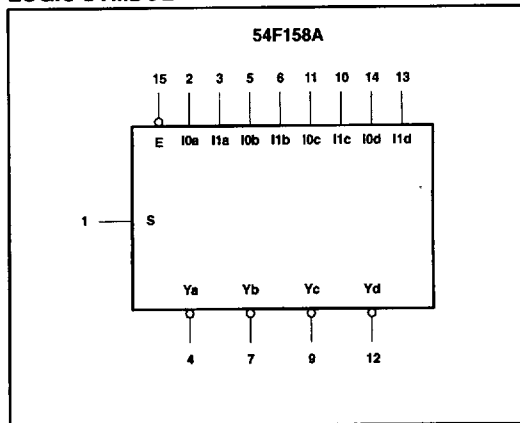
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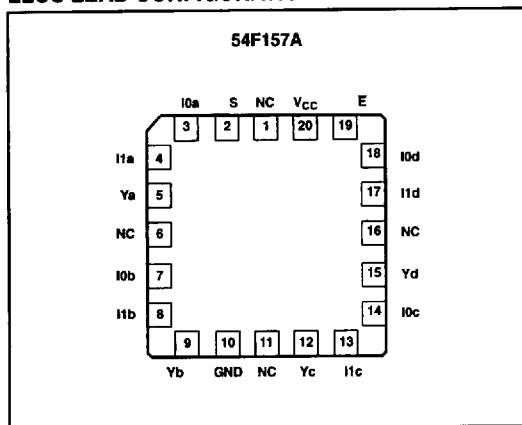
PIN CONFIGURATION



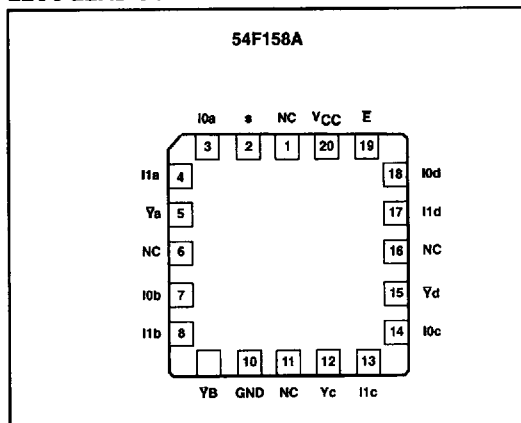
LOGIC SYMBOL



LLCC LEAD CONFIGURATION



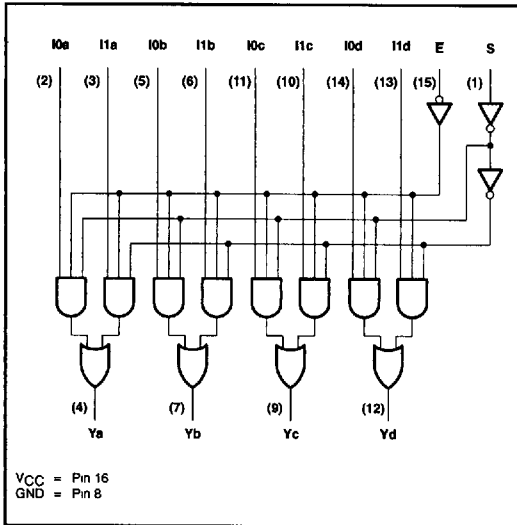
LLCC LEAD CONFIGURATION



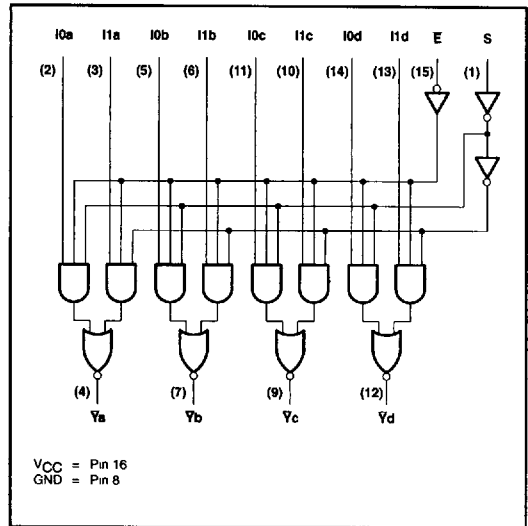
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LOGIC DIAGRAM 54F157A



LOGIC DIAGRAM, 54F158A



FUNCTION TABLE, 54F157A

| ENABLE | SELECT INPUT | DATA INPUTS | | OUTPUT |
|--------|--------------|----------------|----------------|--------|
| | | I ₀ | I ₁ | |
| H | X | X | X | L |
| L | H | X | L | L |
| L | H | X | H | H |
| L | L | L | X | L |
| L | L | H | X | H |

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

FUNCTION TABLE, 54F158A

| ENABLE | SELECT INPUT | DATA INPUTS | | OUTPUT |
|--------|--------------|----------------|----------------|--------|
| | | I ₀ | I ₁ | |
| H | X | X | X | H |
| L | L | L | X | H |
| L | L | H | X | L |
| L | H | X | L | H |
| L | H | X | H | L |

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

ABSOLUTE MAXIMUM RATINGS

(Operation beyond the limits set forth in this table may impair the useful life of the device. Unless otherwise noted these limits are over the operating free-air temperature range.)

| SYMBOL | PARAMETER | RATING | UNIT |
|------------------|--|-------------------------|------|
| V _{CC} | Supply voltage range | -0.5 to +7.0 | V |
| V _I | Input voltage range | -0.5 to +7.0 | V |
| I _I | Input current range | -30 to +5 | mA |
| V _O | Voltage applied to output in High output state range | -0.5 to V _{CC} | V |
| I _O | Current applied to output in Low output state | 40 | mA |
| T _{STG} | Storage temperature range | -65 to +150 | °C |

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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 | | | +0.8 | V |
| I _{IK} | Input clamp current | | | -18 | mA |
| I _{OH} | High-level output current | | | -1 | mA |
| I _{OL} | Low-level output current | | | 20 | mA |
| T _A | Operating free-air temperature range | -55 | | +125 | °C |

DC ELECTRICAL CHARACTERISTICS

(Over recommended operating free-air temperature range unless otherwise noted.)

| SYMBOL | PARAMETER | TEST CONDITIONS ⁴ | LIMITS | | | UNIT |
|------------------|---|--|--------|------------------|------|------|
| | | | Min | Typ ⁵ | Max | |
| V _{OH} | High-level output voltage | V _{CC} = Min, V _{IH} = Min, V _{IL} = Max, I _{OH} = Max | 2.5 | | | V |
| V _{OL} | Low-level output voltage | V _{CC} = Min, V _{IH} = Min, V _{IL} = Max, I _{OL} = Max | | 0.35 | 0.50 | V |
| V _{IK} | Input clamp voltage | V _{CC} = Min, I _I = I _{IK} | | -0.73 | -1.2 | V |
| I _{IH2} | Input current at maximum input voltage | V _{CC} = Max, V _I = 7.0V | | 5 | 100 | μA |
| I _{IH1} | High-level input current | V _{CC} = Max, V _I = 2.7V | | 1 | 20 | μA |
| I _{IL} | Low-level input current | V _{CC} = Max, V _I = 0.5V | | -0.4 | -0.6 | mA |
| I _{OS} | Short-circuit output current ⁶ | V _{CC} = Max, V _O = 0.0V | -60 | -80 | -150 | mA |
| I _{CC} | Supply current ⁷ (total) | 'F157A | | 15.0 | 23.0 | mA |
| | | 'F158A | | 10.0 | 15.0 | mA |

NOTES:

- For conditions shown as Min or Max, use the appropriate value specified under recommended operating conditions for the applicable type and function table for operating mode.
- All typical values are at V_{CC} = 5V, T_A = 25°C.
- Not more than one output should be shorted at a time. For testing I_{OS}, the use of high-speed test apparatus and/or sample-and-hold techniques are preferable in order to minimize internal heating and more accurately reflect operational values. Otherwise, prolonged shorting of a High output may raise the chip temperature well above normal and thereby cause invalid readings in other parameter tests. In any sequence of parameter tests, I_{OS} tests should be performed last.
- I_{CC} is measured with 4.5V applied to all inputs and all outputs open.

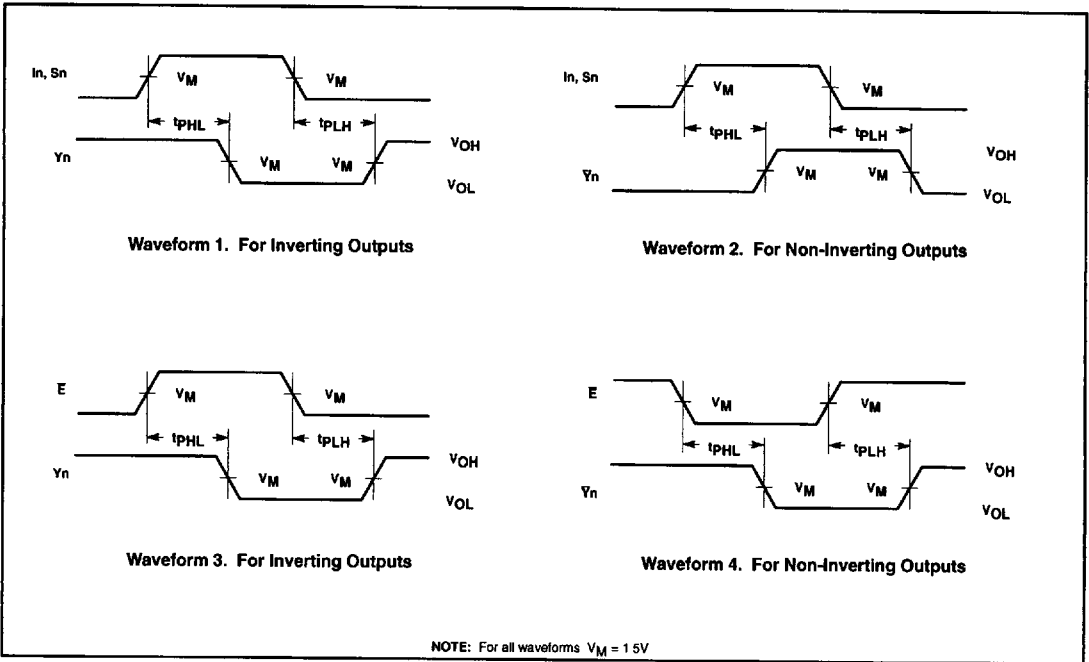
AC ELECTRICAL CHARACTERISTICS

| SYMBOL | PARAMETER | TEST CONDITION | LIMITS | | | | | | UNIT |
|--------------------------------------|---------------------------------------|----------------|---|-----|------|---|------|----|------|
| | | | T _A = +25°C V _{CC} = +5.0V C _L = 50pF, R _L = 500Ω | | | T _A = -55°C to +125°C V _{CC} = +5.0V ± 10% C _L = 50pF, R _L = 500Ω | | | |
| | | | Min | Typ | Max | Min | Max | | |
| t _{PLH} t _{PHL} | Propagation delay Data to output | Waveform 2 | 3.5 | 4.5 | 6.5 | 2.5 | 8.0 | ns | |
| | | | 2.5 | 3.5 | 5.0 | 1.5 | 7.0 | ns | |
| t _{PLH} t _{PHL} | Propagation delay Enable to output | Waveform 1 | 5.0 | 7.5 | 9.0 | 5.0 | 12.5 | ns | |
| | | | 4.0 | 5.0 | 6.5 | 3.5 | 7.5 | ns | |
| t _{PLH} t _{PHL} | Propagation delay Select to output | Waveform 2 | 5.5 | 7.5 | 10.0 | 5.0 | 12.0 | ns | |
| | | | 4.5 | 6.0 | 7.5 | 4.0 | 9.5 | ns | |
| t _{PLH} t _{PHL} | Propagation delay Data to output | Waveform 3 | 3.0 | 4.0 | 6.0 | 2.5 | 9.0 | ns | |
| | | | 1.5 | 2.5 | 4.0 | 1.0 | 5.0 | ns | |
| t _{PLH} t _{PHL} | Propagation delay Enable to output | Waveform 4 | 4.0 | 5.5 | 7.0 | 4.0 | 8.0 | ns | |
| | | | 5.0 | 6.0 | 7.5 | 5.0 | 8.5 | ns | |
| t _{PLH} t _{PHL} | Propagation delay Select to output | Waveform 3 | 4.5 | 6.5 | 8.5 | 4.0 | 12.0 | ns | |
| | | | 4.0 | 5.5 | 7.5 | 3.5 | 10.0 | ns | |

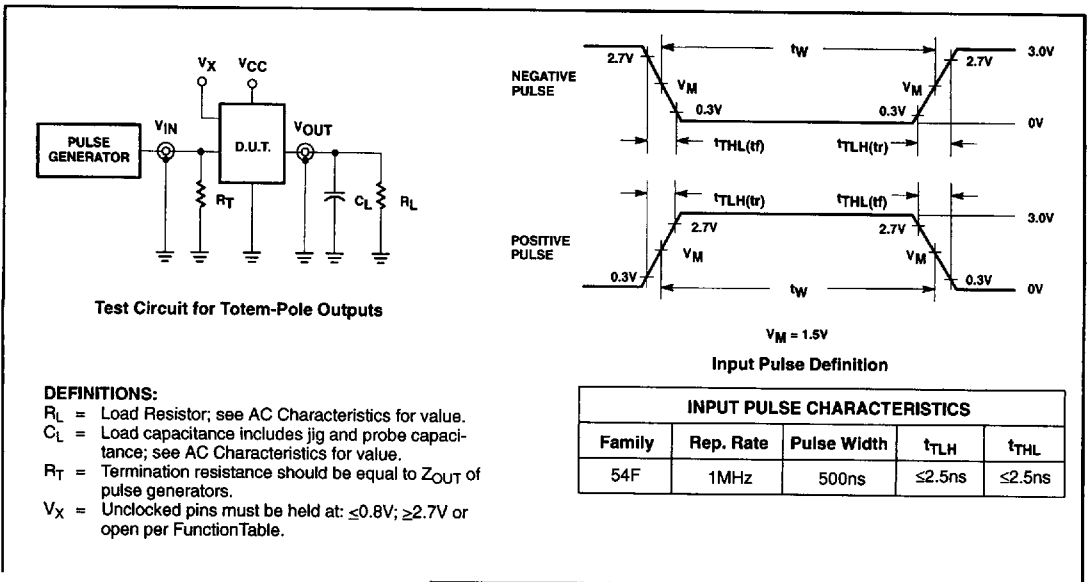
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AC WAVEFORMS



TEST CIRCUIT AND WAVEFORM



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