

EEL3701

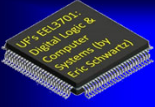
Menu

- More MSI elements
 - > Tri-state Buffers



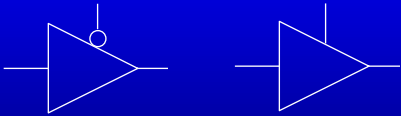
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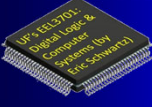
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Tri-State Buffers

- Tri-state buffers have 3 states (unlike other elements we have discussed which have 2 states: 1/0, T/F, or H/L)
- The third state is the Z-state or “high-impedance” state
- Some tri-state symbol are:
 
- This above left symbol has an active-low enable input and active-high inputs and outputs; the one of the right has an active-high enable

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 **EEL3701** **Tri-State Buffer**

Truth Table

E	D	Y
0	-	Hi-Z
1	0	0
1	1	1

Voltage Table

E	D	Y
L	L	L
L	H	H
H	-	Hi-Z

Truth Table

E	D	Y
0	-	Hi-Z
1	0	0
1	1	1

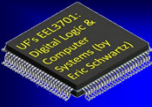
Voltage Table

E	D	Y
L	L	H
L	H	L
H	-	Hi-Z

74'125: Quad 3-state buffer

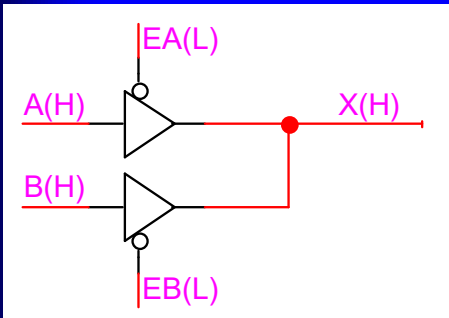
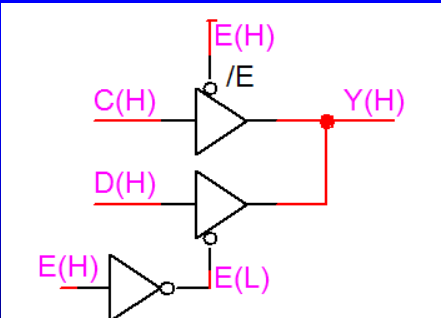
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 **EEL3701** **Tri-State Buffers**

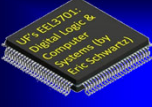
• **Go to LogicWorks™**

How do tri-state buffers compare to open-collect outputs?
 > In LogicWorks see (Buffer-1 O.C.)

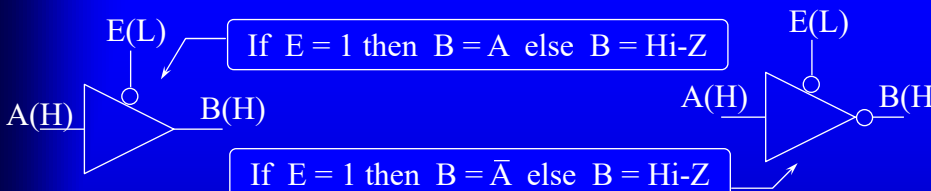



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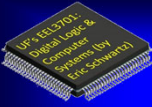
Tri-State Buffers



- Outputs are: High, Low, and Hi-Z (High Impedance), i.e., tri-State (where impedance is related to resistance)
- Ohm's Law: $V = I Z$ or $I = V / Z$
- Thus, for a fixed voltage (5V, 3.3V, or 0V), the higher the Z , the lower the current (Amps) $\Rightarrow$ as $Z \rightarrow \infty$, $I \rightarrow 0 \Rightarrow$ open circuit

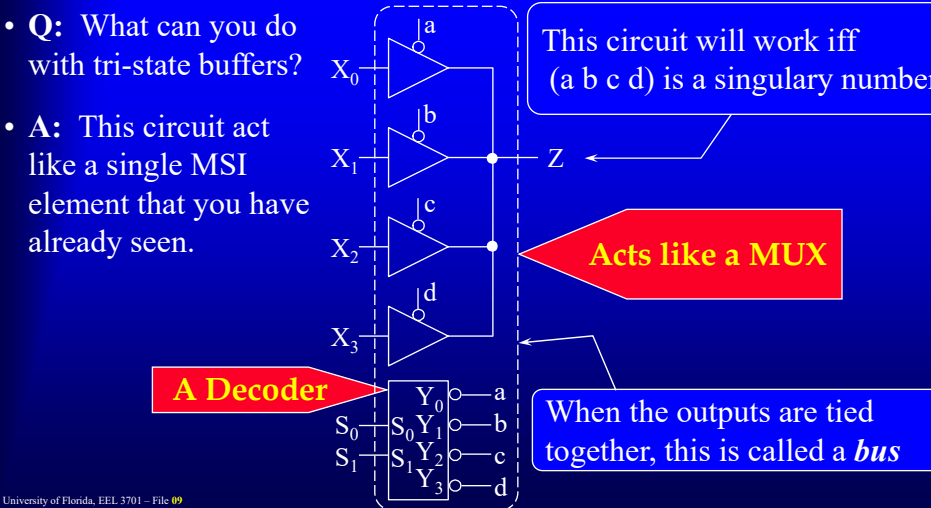
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Tri-State Buffers as _____

- **Q:** What can you do with tri-state buffers?
- **A:** This circuit act like a single MSI element that you have already seen.



This circuit will work iff (a b c d) is a singular number

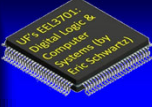
Acts like a MUX

A Decoder

When the outputs are tied together, this is called a *bus*

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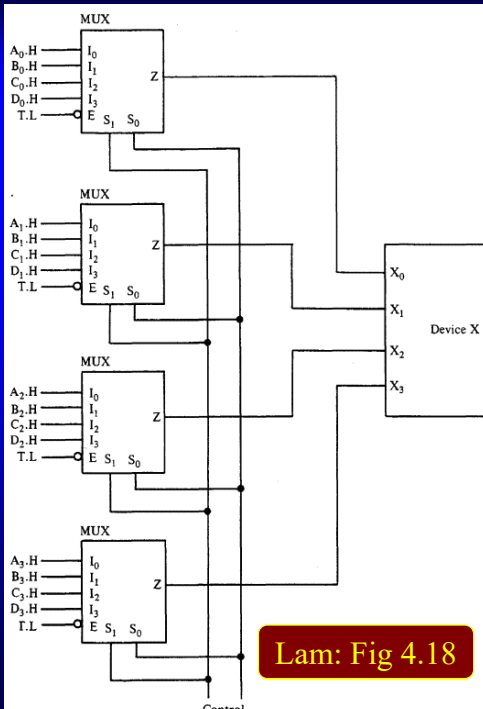
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MUX for Bus

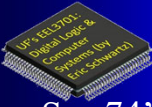
- 4-bit bus is created
- Four devices connected



Lam: Fig 4.18

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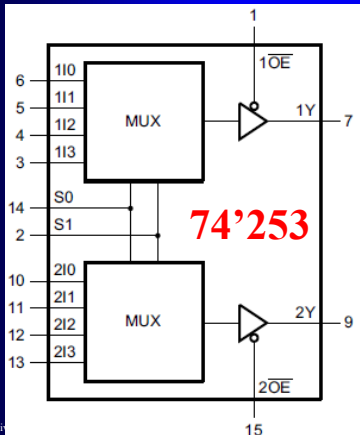
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4-input MUX w/ 3-state Enable

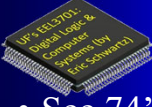
- See 74'253
 - > Dual 4-input MUXes w/ 3-state enable
 - > Compare to 74'153 w/ **non**-3-state enable



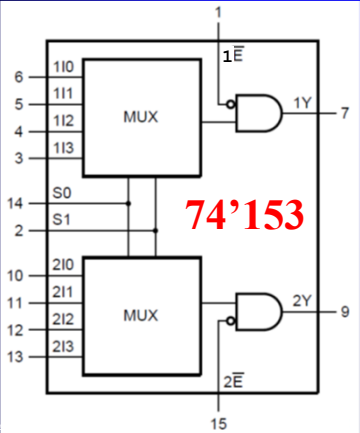
74'253

E	S ₁	S ₀	I ₃	I ₂	I ₁	I ₀	Z
0	-	-	-	-	-	-	Hi-Z
1	0	0	-	-	-	0	0
1	0	0	-	-	-	1	1
1	0	1	-	-	0	-	0
1	0	1	-	-	1	-	1
1	1	0	-	0	-	-	0
1	1	0	-	1	-	-	1
1	1	1	0	-	-	-	0
1	1	1	1	-	-	-	1

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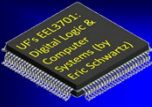
 **EEL3701** 4-input MUX w/ **non-3-state Enable**

- See 74'153
 - > Compare to 74'153 w/ **non-3-state enable**
 - > Compare to 74'253 MUXes w/ 3-state enable



E	S ₁	S ₀	I ₃	I ₂	I ₁	I ₀	Z
0	-	-	-	-	-	-	0
1	0	0	-	-	-	0	0
1	0	0	-	-	-	1	1
1	0	1	-	-	0	-	0
1	0	1	-	-	1	-	1
1	1	0	-	0	-	-	0
1	1	0	-	1	-	-	1
1	1	1	0	-	-	-	0
1	1	1	1	-	-	-	1

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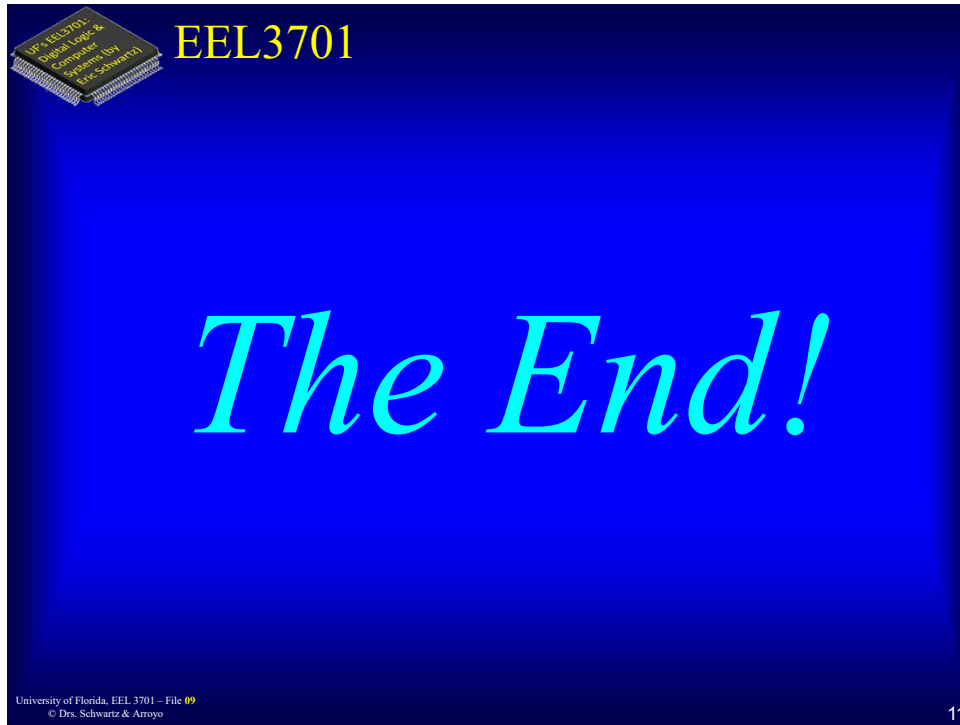
 **EEL3701** Expansion with MSI Devices

- Compare 74'153 and 74'253
 - > Also on our website under Software/Docs
 - > Look at data sheets on the internet (Google search)
 - > See also 74HCxxx link on our website

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